

Acta Genetica et Statistica Medica ²⁷

In association with

Otto L. Mohr

Professor of Anatomy, Oslo

Tage Kemp

Professor of Human Genetics,
Copenhagen

edited by:

Gunnar Dahlberg

Head of the State Institute of Human Genetics and Race Biology, Uppsala

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INTRODUCTION

It is natural that, in the world of medicine, it was the environmental factors causing disease which were first dealt with. These, unlike the genetical factors, are comparatively easy to combat. However, before the problems of disease can be fully solved, the genetical factors must also be taken into account, and research into human genetics has gradually come more and more to the fore, until it might well warrant a journal to itself. The genetic investigations on man which have been carried out hitherto have, however, been printed in periodicals of very varying kinds – some in periodicals on genetics, which hardly any medical man reads, and some in medical periodicals, which are not read by geneticists. From this point of view, too, it would be an advantage to have a periodical devoted to Human Genetics.

The solution of problems in this sphere must naturally include the consideration of environmental factors. The diseases are few and, above all, rare that can be considered as purely genetical, i. e. impervious to environmental factors, compared with the relatively large number of diseases where genetical and environmental factors both play a part. Therefore, this periodical will also accept papers bearing on factors of environment, particularly such as take into account the make-up of populations.

That is to say, two fundamental angles can be distinguished in Human Genetics:

1. What will the children of any given marriage be like? We can assume here that we have a more or less extensive knowledge of the two parents and of the characters of their relatives.

2. What will be the future make-up of a population, given more or less detailed data on its present make-up and on the crossings taking place within it?

The latter problem is naturally the most important from a social viewpoint, and it has also begun to receive more attention in recent times. In both cases it is necessary, for scientific work, to use statistical methods. Consequently, investigations of a statistical nature will be particularly welcome in this periodical, especially – as stated above – such as deal with the make-up of populations, though it will also publish investigations more interesting to medicine as regards methods. In other words, the periodical will have a special appeal for medical men, but will not neglect the interests of those geneticists who are concerned with human genetics.

Gunnar Dahlberg.

AVANT-PROPOS

Il n'est que naturel qu'on se soit dans le domaine de la médecine occupé en premier lieu des causes de maladies trouvées dans l'entourage même du malade. Celles-ci sont faciles à combattre par opposition aux facteurs génétiques. Il est toutefois nécessaire, avant de pouvoir résoudre complètement les problèmes de la maladie, d'en tenir compte et c'est pourquoi les recherches concernant les lois de l'hérédité humaine ont progressivement gagné du terrain, au point de justifier aujourd'hui un propre périodique. Les publications de ce domaine, dispersées jusqu'ici, se trouvaient publiées soit dans des revues génétiques à la portée de peu de médecins, soit dans des périodiques médicaux que les généticiens lisaient rarement. Il semble avantageux de ce point de vue de créer un journal consacré à l'étude de l'hérédité.

La solution des problèmes inhérents doit naturellement tenir compte des facteurs du milieu. Il y a peu et de rares maladies à considérer du point de vue génétique seulement, comparées au relativement grand nombre de maladies basées à la fois sur des facteurs héréditaires et de l'entourage. C'est pourquoi cette revue se propose également de publier des travaux ayant trait aux facteurs du milieu et, en particulier, aux principes génétiques des populations.

Deux questions fondamentales se posent en hérédité humaine :

1. Quels seront les enfants d'un mariage déterminé ? Il est à présumer dans ce cas que nous possédons des connaissances plus ou moins complètes des père et mère, ainsi que des caractères de la parenté.

2. Quel sera l'état futur d'une population, étant donné des dates plus ou moins précises relatives à sa structure actuelle et les croisements présents ?

Le second problème — étant des plus importants du point de vue social — a attiré ces derniers temps déjà l'attention des investigateurs. L'étude des deux cas nécessitent toutefois des méthodes statistiques. Pour cette raison des explorations statistiques et, ainsi qu'il a été relevé plus haut, en particulier celles s'occupant de la structure héréditaire des populations, seront acceptées avec intérêt, bien que paraîtront également des travaux intéressant plus spécialement le médecin. Ainsi le journal se consacrera aussi bien aux médecins qu'aux investigateurs de l'hérédité humaine.

Gunnar Dahlberg.

ZUM GELEIT

Es ist nur natürlich, daß man sich auf dem Gebiete der Medizin zuerst mit den Krankheitsursachen beschäftigt hat, die man in der Umgebung des Kranken fand. Diese sind leicht zu bekämpfen im Vergleich mit den Faktoren der Vererbung. Es müssen aber, bevor die Probleme der Krankheiten vollständig gelöst werden können, auch die genetischen Faktoren berücksichtigt werden; darum rückte die Forschung auf dem Gebiete der menschlichen Erblchkeitslehre immer mehr in den Vordergrund, und nun scheint es an der Zeit zu sein eine eigene Zeitschrift auf diesem Gebiete zu gründen. Alle Publikationen waren bisher weit verstreut und in Zeitschriften der verschiedensten Art gedruckt – einige in Zeitschriften für Vererbungsforschung, welche Mediziner kaum gelesen haben, andere in medizinischen Zeitschriften, welche wiederum Vererbungsforschern nicht zu Gesicht kamen. So scheint es vorteilhaft, eine Zeitschrift zu besitzen, die sich der menschlichen Erblchkeitsforschung widmet.

Die Lösung der Probleme dieser Art muß natürlich die Beachtung der Umgebungs-Faktoren einschließen. Die Krankheiten, die allein vom genetischen Standpunkt aus betrachtet werden können, sind gering an Zahl und noch dazu selten, verglichen mit der relativ großen Zahl von Krankheiten, bei denen sowohl genetische wie Umgebungs-Faktoren eine Rolle spielen. Darum wird diese Zeitschrift auch Arbeiten veröffentlichen, die auf Umgebungs-Faktoren basieren, besonders solche, die den Bevölkerungs-Aufbau in Rechnung ziehen.

Man kann vielleicht zwei fundamentale Angelpunkte in der menschlichen Vererbungslehre bezeichnen:

1. Wie werden die Kinder aus einer bestimmten Ehe sein? Hier können wir voraussetzen, daß wir eine mehr oder weniger gute Kenntnis der beiden Eltern und der Charaktere ihrer Verwandten besitzen.

2. Wie wird die künftige Zusammensetzung einer Bevölkerung sein, wenn mehr oder weniger detaillierte Daten über ihren gegenwärtigen Aufbau und die dabei vorkommenden Kreuzungen vorhanden sind?

Das letztere Problem ist natürlich das viel wichtigere vom sozialen Gesichtspunkt aus, und es hat auch schon in neuerer Zeit begonnen, mehr Aufmerksamkeit auf sich zu lenken. In beiden Fällen aber ist es notwendig, daß die Forschung sich statistischer Methoden bedient. Darum werden Untersuchungen statistischer Natur willkommen sein und besonders gern – wie oben ausgeführt – solche Arbeiten aufgenommen

werden, die sich mit dem Aufbau von Bevölkerungen beschäftigen;
doch werden selbstverständlich auch Forschungen publiziert werden,
die mehr die medizinischen Interessen berücksichtigen. Mit anderen
Worten, die Zeitschrift wendet sich besonders an Mediziner, wird aber
immer auch den Interessen all der Forscher dienen, die sich mit der
menschlichen Vererbung beschäftigen.

Gunnar Dahlberg.

THE PROGNOSIS IN SCHIZOPHRENIA

by SVEN STENBERG †, Stockholm

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Introduction.

It is of interest to try to reach a general idea of prognosis in the case of schizophrenia and to obtain figures which indicate the possibilities of improvement, of shorter or longer remissions, and of more or less complete recovery both for men and for women.

It is, of course, also desirable to go further and try to reach a more differentiated prognosis, so that, if possible, more precise statements can be made about the future chances of patients with different symptoms, age and type, etc. The relatives, and in some cases the patient too, naturally wish to receive a fairly clear answer to the question as to what the course of the illness will be.

In this field one finds several investigations concerning these problems but unfortunately these are very unsatisfactory from a statistical point of view. In connection with the more precise formulation of the problem I shall in the following discuss those sources of errors which more or less strongly diminish the value of earlier investigations.

As a matter of principle the problem is simple. One observes a sufficiently great number of cases from the time when the illness starts and afterwards one has merely to compute how many have totally recovered or have improved, how many fall ill again, and how many remain ill from one year to the next.

Actually one encounters difficulties in making an investigation along these lines. One cannot begin the investigation when the illness starts, since the patients cannot always be observed at the very moment when they become ill. The observations can only begin

when the patient enters the hospital and one can then only obtain a more or less probable view as to whether or not the illness has suddenly developed, or whether the patient has shown signs of illness a long time before being admitted. Thus, one has to start with the patients who, during a certain period, have been admitted to a hospital for the first time and one must afterwards follow them. If one wishes to know whether the patient will remain normal or what risk there is for a relapse, one has to observe him even after he has left the hospital which might sometimes be difficult. It can, however, easily happen that if the material for an investigation as to prognosis is collected in this way the results could be misleading. If one limits oneself to investigate the cases which during a certain period have entered a hospital for the first time, the material will be smaller than if one investigates all the cases which are available during that period of time. In case one enlarges the material in this way it will be misleading if one treats it in the usual manner. Suppose one starts with all patients who at a certain moment or in a certain period are present at the hospital. In this case one starts, of course, to observe the patients at varying distances from the beginning of their illness. Inasmuch as one limits oneself to follow the patients in the future, the frequency of recovery does not refer to the beginning of the illness but to quite varying periods of time during the course of the illness. The percentage of recovery which might be computed refers therefore to an uncertain point in the course of the illness and such a figure is, of course, too low.

Perhaps due to the feeling that this is true, in some investigations the course of illness has been traced back to the beginning and one has in this way been able to compute the frequency of recovery from the start of the illness. Such a grouping of material which has been collected as indicated above, gives, however, misleading and, in general, unfavorable figures. If, at the time when the investigation starts a patient is present at the hospital but was taken ill, for example, five years before, and if one investigates the patient's past to the beginning of the illness, then the patient has no chance to be recovered five years after having fallen ill. The reason why the patient has been included in the material is evidently that he is ill five years after the beginning of the illness. One can also express the fact in the following manner: patients who fell ill five years before are included in the material as well as those patients who fell ill one year before the investigation started, insofar as

they were ill at the time when the investigation began. On the other hand, those patients who fell ill at the same dates as the ones mentioned above, but who recovered before the period of observation began, are not included. One selects the patients for investigation on the basis of the fact that they *were ill* after a certain period of time, but one does not select them merely because they *became ill* during a certain period of time.

Even though in this manner a material may be misleading, nothing prevents giving tables which in a formal way give a correct impression and from which one can compute a probability for recovery at different times after the beginning of the illness. The systematic error which is associated with the selection of the cases does not appear directly in those tables which result from the treatment of the material, but it evidently gives incorrectly low figures for the probability of improvement or recovery.

Sources of error of this kind seem nearly always to be present in existing investigations. In some of the investigations this is clearly evident in the report. In others it is impossible to prove that such sources of error exist. The lack of information of how the material has been collected shows, however, that the author has not seen the imminent danger of obtaining misleading figures. Since the statement as to how the material was collected is incomplete and lacking in clearness one has indeed reason to suspect that the material was not collected in a satisfactory way.

However, not only those questions which concern the selection of cases at a certain period of time are important. Other factors of selection, namely those which concern the diagnostic differentiation are also important, and can influence the result which one obtains at a prognostic investigation. When the cases are judged in regard to symptomatology one can afford to be a little less accurate or rather one can draw the boundary more or less liberally. In any material there are cases in which the clinical symptoms leave room for doubt and where therefore the diagnosis schizophrenia must be accompanied by a questionmark. Different authors may draw the boundary in different ways, even though on the whole there is now a certain agreement as to the criteria of the diagnosis.

In this connection we must, however, discuss the factor of time once again. In making the diagnosis, one does not only take account of the symptomatology, to a certain degree the judgment is influenced by the course of the illness. At any rate lighter and temporary

symptoms are more apt to lead to a doubt in the diagnosis than is the case if the same symptoms persist during a longer time. There are even authors who claim that schizophrenia is never completely cured.

Survey of the literature.

Table 1 gives a survey of the available literature concerning the prognosis of schizophrenia. As is evident from this table the figures are varying to a high degree. Some investigators record only a small percentage of patients as recovered, while others have noted 50 % as recovered. To some degree these differences depend on random variations, particularly where the material has been small. The main reason for the differences might, however, be of another kind.

First of all one must take into account the fact that the material has been *delimited in different ways*. For instance the investigation which has been made by *Zabrocka* (1908) includes 500 cases from *Bleuler's* clinic Burghölzli in Zürich and in accordance with the view which *Bleuler* then had of the illness, no patient recovers. In other words, if a patient recovered he was not supposed to have suffered from schizophrenia. The fact that half of the patients have improved has therefore little interest, since the material evidently is selected in a special way. Besides, the improvement in question is not particularly pronounced in a number of cases. In fact, the final condition of the patient is divided into mild hebephrenia, fairly strong hebephrenia, and strong hebephrenia. The patients with mild hebephrenia amount to 60 %.

Stearns' (1912) investigations refer to 359 cases of schizophrenia. Some of these, however, have been transferred from homes for the aged to the hospitals. A considerable number of these patients must have been cases who have been ill for a long time before the observation began. One can therefore assume that the figure which *Stearns* gives for recovered and improved, namely 5 %, is too low.

Otto-Martiensen's (1921) material has been selected in the opposite direction, since 150 cases which had been ill for a long time were eliminated. On the other hand, cases with the diagnosis paranoia were included. One can perhaps therefore assume that the figure for improvement which the investigator obtains, namely 33.7 % is too high.

Braun also (1927) has a selected material, that is to say, that 178 old cases have been included which had been ill for a rather

Table 1.

| Author, year | Material | | | Results (in per cent) | | | | Remarks |
|------------------------------------|-----------|-------------|---------------------|------------------------|---------------------|--------------|------|--|
| | All cases | Re-examined | Observ. time, years | Recovered and improved | Cases of re-mission | Not improved | Dead | |
| <i>Zablocka</i> 1908 | 647 | 515 | 3-10 | 60.0 | — | 40.0 | — | Selected cases. Character of last stage not clear. |
| <i>Schmid</i> 1911 | 636 | 455 | 1-10 | 31.7 | — | 57.9 | 10.2 | Only discharged patients. |
| <i>Stearns</i> 1912 | 395 | 315 | 6-10 | 5.0 | — | 68.6 | 23.8 | Selected patients. Observ. time of varying length. |
| <i>Otto-Martensen</i> 1921 | 527 | 312 | ? | 33.7 | — | 28.3 | 31.4 | Selection of old cases. Observ. time of varying length. |
| <i>Strecker and Willey</i> 1927 | 186 | — | ? | 20.4 | — | — | — | No information as to the character of the cases. |
| <i>Braun</i> 1927 | 716 | 139 | 1-2 | 20.9 | 3.6 | 54.0 | 2.9 | Selected material including old cases. The per cent figure has been calculated on those who have been re-examined. |
| <i>Mayer-Gross</i> 1932 | 328 | 294 | 16-17 | 34.9 | — | 22.4 | 42.5 | Selected cases; patients in hospital. |
| <i>Schulz</i> 1933 | 660 | 660 | 20 | 15.9 | 8.3 | 52.5 | 24.1 | Selected cases of special character. |
| <i>Murdoch</i> 1933 | 75 | — | 1 | 16.0 | — | 69.3 | 14.7 | Selected criminal cases. |
| <i>Wootton and others</i> 1935 | 98 | 89 | 3-6 | 22.6 | 16.8 | 60.0 | — | Selected cases; patients in hospital. |
| <i>Bratoy</i> 1936 | 295 | 208 | 6 | 9.2 | — | 90.9 | — | Observ. time of varying length. Partly old cases. |

Table 1 (continued)

| Author, year | Material | | | Results (in per cent) | | | | Remarks |
|-------------------------------------|-----------|-------------|---------------------|------------------------|--------------------|--------------|------|--|
| | All cases | Re-examined | Observ. time, years | Recovered and improved | Cases of remission | Not improved | Dead | |
| <i>Evensen</i> 1936 | 815 | 815 | 4-18 | 32.4 | — | 54.8 | 12.8 | Discharged patients. |
| <i>Horwitz and Kleiman</i> 1936 | 170 | — | 7 months | 22.4 | — | 72.9 | 4.7 | Discharged patients. |
| <i>Arnesen</i> 1937 | 815 | — | — | 17.5 | — | — | — | Discharged patients. |
| <i>Fromenty</i> 1937 | 271 | — | ? | 15.0 | 15.0 | 70.0 | — | Selected cases. |
| <i>Romano and Ebaugh</i> 1938 | 600 | 345 | 1-5 | 23.5 | — | 76.4 | — | The character of the cases not clear. |
| <i>Hunt and others</i> 1938 | 641 | — | ? | 35.1 | — | — | — | Observ. time of varying length. |
| <i>Taylor and v. Salzen</i> 1938 | 1100 | — | 3-8 | discharged = 54 | — | — | — | Has only been available in abstract. |
| <i>Cheney and Drewry</i> 1938 | 500 | — | 3 | 12 | — | 60.0 | — | Has only been available in abstract. |
| <i>Salm</i> 1938 | 133 | ? | 8-10 | discharged = 33 | 15 | 39 | 13 | Selection of special character. |
| <i>Whitehead</i> 1938 | 105 | — | 5 | 51 | — | — | — | Selected cases. Partly old patients. |
| <i>Briner</i> 1938 | 220 | 201 | 2-5 | 40.3 | — | 36.3 | 15.0 | Has only been available in abstract. |
| <i>Hayashi and Akimoto</i> 1939 | 2000 | 565 | 4-21 | 37.8 | — | 30.6 | 30.0 | Selection including old cases, Observ. time of varying length. |
| | | | | | | | | Has only been available in abstract. |

Table 1 (continued)

| Author, year | Material | | | Results (in per cent) | | | | Remarks |
|---|-----------|-------------|---------------------|------------------------|--------------------|--------------|------|--|
| | All cases | Re-examined | Observ. time, years | Recovered and improved | Cases of remission | Not improved | Dead | |
| <i>Lehoczky</i> and others 1939 | 218 | 132 | 1-20 | 35.6 | — | 59.1 | 5.3 | The character of the cases not clear. |
| <i>Stalker</i> 1939 | 133 | 129 | 1-6 | 29 | 21 | 50 | — | Observ. time of varying length. Possibly not selected cases |
| <i>Guttmann</i> and others 1939 | 188 | 184 | 3-4 | 34.5 | 13.2 | 46.0 | 4.1 | Selection of special character. |
| <i>Rennie</i> 1939 | 500 | — | 1-10 | 42.7 | — | 57.3 | — | Selection from old cases. |
| <i>Neumann</i> and <i>Finkenbrink</i> 1939 | 4254 | — | 1-20 | 32.9 | — | 43.5 | 23.6 | The character of the cases not clear. |
| <i>Gelperin</i> 1939 | 235 | — | 1½-5 | discharged = 40 ? | — | — | — | The result of the re-examination not clear. |
| <i>Osborn</i> 1940 | 339 | — | 5 | discharged = 44 | — | — | — | The result of the re-examination not clear. |
| <i>Blaire</i> 1940 | 120 | — | 1-5 | discharged = 15.7 | — | — | — | Has been available only in abstract. |
| <i>Schmidt</i> and <i>Kortmann</i> 1940 | 213 | 209 | 2-7 | 9.5 | — | 82.5 | 1.0 | The character of the cases not clear. |
| <i>Hoffmann</i> and others 1941 | 194 | 127 | 1-10 | 77.2 | — | — | — | Observ. time of varying length. Selection of special character. |
| <i>Kant</i> 1941 | 102 | — | 5-15 | 50.0 | — | — | — | Has only been available in abstract. |
| <i>Bleuler</i> 1941 | 200 | — | ? | 40.0 | — | 40.0 | — | The character of the cases not clear. |

long time before the investigation had started. In spite of this he obtains the figure 20.9 % as improved. It is impossible to judge to what degree this figure has been influenced by the fact that the material was selected.

Murdoch's investigation (1933) comprises only criminal patients. The material is therefore selected in a particular way and besides is very small, only 75 cases.

Braatoy himself (1936) declares that in his material are included patients who have been treated in other hospitals and that the first admission to the hospital does not mean that the patients have not been treated in other hospitals before. It is therefore likely that the figure at which he has arrived, namely 9.2 %, is too low.

A selected material is also the basis for the investigation by *Cheney* and *Drewry* (1938). Several old cases are included in the material. The authors find 12 % improved, which also is probably too low.

The investigation which has been carried out by *Salm* (1938) contains a small material of 133 cases, of which 27 have been ill for more than 3 years before the admission. There is no information as to whether or not the patients have been in other hospitals before. Only 4 had recovered and 9 were improved at the end of observation.

In the investigation by the Japanese *Hayashi* and *Akimoto* (1939) the material is also biased. It is mentioned that the prognosis is least favorable for those who have been ill 3–6 years before the admission, which shows that part of the material deals with old cases. It is therefore astonishing that as many as 21 % are said to be completely recovered.

The investigation by *Briner* (1938) comprises 220 cases, part of which, it is said, have been ill before, although they have had remissions and afterwards been admitted to the clinic. 40.3 % of these are recorded as recovered to a certain degree. The high percentage indicates that the material is not typical even with regard to other factors of selection.

Lehoczky, *Eszenyi* and others (1939) report about a material of 208 cases, 132 of which were able to be subjected to a later investigation. Part of the patients are said to have been treated up to 20 years. Under these circumstances the material must have been selected. It is said to consist of cases which have been discharged from the hospital from 1930 to 1935, and an observation period of

20 years could not have been achieved if it had been a question of newly admitted cases. The material is meant to serve as a comparison with cases which have had shock treatment, and is therefore probably selected also from this point of view.

An investigation which has been made by *Guttman, Mayer-Gross and Slater* (1939) contains 188 patients who *prima facie* are said to have favorable prospects, since only such patients had been admitted to the hospital. It is therefore not very surprising that 34.3 % are said to have improved.

The investigations described above are therefore based on material, which is selected from different points of view and particularly on material, which in order to increase the number of cases includes old cases which at the beginning of the investigations did not have much chance of recovery.

Another group of investigations are based on *discharged* patients in order to find out what became of them. The material is therefore also biased, but the selection now lies in the opposite direction. If the patients had been discharged according to the same criteria, the figures could still be of a certain interest. But standards for discharge are very different. In hospitals where there is lack of places, one discharge more frequently, of course, than in others. Moreover, to what degree one dares to discharge patients is a matter of great variation depending upon the physician's readiness to take risks, the possibilities of care at home for the patient, etc.

Investigations as to prognosis in the case of discharged patients have been made by *Schmid* (1911), *Wootton* and others (1935), *Evensen* (1936), *Arnesen* (1937), *Horwitz* and *Kleiman* (1936) and *Kant* (1941). It is for the reasons given above hardly of interest to comment the results of these investigations.

It is possible that in some of the other investigations the material has been selected in a misleading way. This is indicated by the fairly improbable numerical results, which have occasionally been obtained. However, the accompanying report is, as a rule, incomplete, so that one can not judge their reliability. The fact that the respective authors do not especially discuss the issue of selection indicates that they have not paid attention to the source of error which this point involves. It should, however, be mentioned that *Mayer-Gross* (1932) points out that a cross-section consisting of cases which have been ill for different times can not give a true picture of the prognosis. This author seems to be the only one who

actually mentions this fact. In spite of this assertion he compares his own results with those of other authors who evidently have biased materials. The figure which he obtains seems to be rather too high. It amounts to 34.9 % of patients who have been discharged – as recovered or improved.

In proceeding with the prognosis one must either compute the probabilities per year in relation to the number of observed patients, or compute the probabilities after a certain period, for example, 5 or 10 years. There are no such investigations which are quite correct from a statistical point of view; the patients have, as a rule, been *observed during widely varying periods of time*. It is evident that a patient who is observed for a year only has much less prospect of recovery than another who is observed for 10 years under the same conditions. The figures which have been given are therefore not clear with respect to their significance. As a rule the authors named above have varying periods of observation. In addition, *Romano and Ebaugh* (1938) have, for instance, a period of observation of 1 to 5 years; *Taylor and v. Salzen* (1938) have a period of observation of 3 to 8 years; *Stalker* (1939), 1 to 6 years; *Rennie* (1939) 1 to 10 years; *Neumann and Finkenbrink* (1939), 1 to 20 years; *Gelperin* (1939), $\frac{1}{2}$ to 5 years; *Blaie* (1940), 1 to 5 years; *Schmidt and Kortmann* (1940) 2 to 7 years; *Hoffmann* and others (1941), less than 1 up to 10 years. Evidently, the figures in the investigations must give quite varying results, because the materials have not been used for computation of the probabilities per annum but only the figures for the total have been given. It is, of course, clear, as has been said before, that those who have been observed for a short period have less prospect of recovery than those who have been observed during a longer period. Some authors give no information whatsoever in regard to the period of observation. This is the case with *Hunt* (1938) and *Bleuler* (1941). However, *Mayer-Gross* has reported a definite period of observation. As has been mentioned before he finds that 34.9 % have recovered after 17 years. Also *Schulz* (1933) and *Osborn* (1940) have reported definite periods of observation, *Schulz* finding 15.9 % recovered after 20 years and *Osborn* finding 44 % discharged from the hospital and returned home. However, it is not clear to what degree these patients are to be regarded as recovered, even if they have improved.

In summarizing it can be pointed out that investigations which have been carried out up to the present time show throughout

methodological defects of various kinds. It might therefore be desirable to subject the problem of prognosis in schizophrenia to a new examination.

The Material.

The selection of cases. In this investigation the intention has been first of all to obtain information as to the prognosis for a schizophrenic who has just fallen ill, and at the same time to weigh the chances of the illness becoming chronic, being permanently cured, or of reappearing after an apparent recovery. For this reason the material had to be selected over a long period of time. In accordance with this the time for the collection of the material was chosen from 1915 to 1929, inclusively, 15 years in all. As has been pointed out in the introduction, it is important for such an investigation to distinguish between those who, during a certain period, are first admitted to the hospital, and those who are in the hospital but not admitted for the first time during this period.

Material I consists of all cases who have just become ill and who were admitted for the first time to Långbro hospital during the period 1915–1929. The patients who had been transferred from other hospitals within a month after their first admission have also been counted as new cases. These cases have afterwards been followed until 1939–1940. The maximum time of observation of the cases admitted at the beginning of this period is about 25 years. The time of observation of the cases who were admitted toward the end of the period is 10 years. In several instances, however, the time of observation has naturally to be interrupted at an earlier date because the patient died or could for some other reason no longer be observed. This material includes 834 cases.

Material II consists of all cases at the hospital not admitted for the first time during the period 1915–1929. In this material belong cases which have been transferred from other hospitals after more than a month of treatment, and furthermore those which were at the hospital at the beginning of the period, and finally, those which were admitted during the period but had previously been treated at Långbro or another hospital. The maximum observation time for these patients covers a period which is notably longer than for those in material I, and for certain cases even extends to 45 years. The time of observation for the latest admissions in this category is about the same as with those in material I, i. e., at least 10 years.

Here also the time of observation may, of course, have been interrupted because the patient died or could, for some other reason, no longer be observed.

Evidently, material II represents a selection of cases which to a lesser degree have recovered and have been dismissed. Patients who have been treated at another hospital and have there rapidly improved, so that they could be dismissed, have not been transferred to Långbro. Those, who were transferred are a selection of the cases which did not improve. That holds true for those admitted before 1915. If such patients improved and were discharged at an earlier time they would, of course, not have been there after 1915. Those who remained, are, therefore, a selection of patients, who did not improve. This material has been included for two reasons: on the one hand, it is of a certain interest to investigate and demonstrate the importance of the factor of selection; on the other hand, the intention has been to use the material for an orientation in respect to symptomatology. This material consists in a total of 794 cases.

Table 2.

Distribution of Material I. (Cases treated at the hospital for the first time 1915-29.)

| Diagnosis | Men | Women | Both sexes |
|--------------------------------------|-----|-------|------------|
| Schizophrenia, definite diagnosis | 307 | 276 | 583 |
| Schizophrenia, doubtful diagnosis: | | | |
| Schiz. + other diagnosis | 17 | 12 | 29 |
| Schiz. + imbecility | 22 | 28 | 50 |
| Schiz. + manico-depressive psychosis | 10 | 18 | 28 |
| Total number of schizophrenics | 356 | 334 | 690 |
| Confusion | 18 | 36 | 54 |
| Paranoia | 18 | 14 | 32 |
| Involution paranoia | — | 17 | 17 |
| Presenile insanity | 5 | 36 | 41 |
| Total number of other diagnoses | 41 | 103 | 144 |
| Total number of cases | 397 | 437 | 834 |

Table 3.

Distribution of Material II. (Cases treated at the hospital during the period 1915-29 except those treated for the first time.)

| Diagnosis | Men | Women | Both sexes |
|--------------------------------------|-----|-------|------------|
| Schizophrenia, definite diagnosis | 291 | 308 | 599 |
| Schizophrenia, doubtful diagnosis: | | | |
| Schiz. + other diagnosis | 17 | 15 | 32 |
| Schiz. + imbecility | 15 | 22 | 37 |
| Schiz. + manico-depressive psychosis | 17 | 20 | 37 |
| Total number of schizophrenics | 340 | 365 | 705 |
| Confusion | 5 | 19 | 24 |
| Paranoia | 7 | 3 | 10 |
| Involution paranoia | — | 15 | 15 |
| Presenile insanity | 5 | 35 | 40 |
| Total number of other diagnoses | 17 | 72 | 89 |
| Total number of cases | 357 | 437 | 794 |

In table 2 material I is reported and in table 3 material II. The schizophrenics have been divided into those with a definite diagnosis of schizophrenia and those whose diagnosis is in doubt. The latter are those whose diagnosis has been accompanied by a question mark or for whom a doubt has been indicated by an alternative diagnosis. In several cases this alternative diagnosis has rather had the effect of adding information than of casting a doubt on the diagnosis of schizophrenia. This is obvious from the hospital records. The doubtful schizophrenics only amount to about 15 % and this in both materials.

Information about these cases was collected from different sources. Some of the patients stayed at the hospital or were located again in another hospital. Some of them had been admitted for renewed treatment. For those who had been discharged, information was collected with the help of different authorities, particularly from the public social register which includes all persons who have received any form of public assistance. Information about those who

died was obtained from the parishes. No information could be obtained about the state of health of 75 cases which were alive at the end of the investigation.

In this connection it must finally be pointed out that even if from a scientific point of view it is of interest to obtain more differentiated information, a rough classification must be made for a prognostic investigation lest the material be split into a great number of various little groups. The most sensible grouping would be one which applies social points of view and judges the cases with regard to their ability to get along in the community. Under these circumstances the information as to the condition of the patients while out of the hospital has been used for the following classifications:

1. *Recovered and able to work.* In this group those cases have been included which have gone back to their original job or, in case of married women, those who have been able to take care of their home in the same way as before they were ill. If one wishes to be cautious, one ought perhaps to use the expression "socially recovered", even though naturally many cases which are completely recovered are included. In this group have, of course, been counted also those who – perhaps after having been discharged from the hospital for a long time – have entered a convalescent home because of their age or similar reasons and who have had no relapse there.

2. *Improved and partly able to work.* Here are counted those cases, which, after the discharge, have more or less been able to take up their work again. Information has been obtained about these patients which enables one to draw the conclusion that some of them have shown certain mental abnormalities.

However, other patients were discharged from the hospital who to a certain degree had still to be regarded as ill even though their condition allowed care outside the hospital. Patients who were discharged in this manner should, of course, not be counted as improved or recovered in deciding about the prognosis for schizophrenia. Naturally, it is of social interest to see to what degree one can take care of patients satisfactorily in less expensive ways. This has, however, nothing to do with the prognosis. In order to be able better to distinguish between the two first mentioned groups, consisting of favorably developing cases, it has been necessary to register also the other cases which were discharged, even if those have not been subject to more detailed discussion in the subsequent

consideration of the investigation. Patients who have not improved were therefore grouped in the following manner:

3. a) *Patients with definitive defects.* To these patients belong those, who could be taken care of in their own homes. Most of them have public assistance, and information gathered about them shows that they are to be regarded as cured but with some remaining defects.

b) Here are included the patients who after the discharge from the hospital have been under care in a family.

c) To this group belong some of those cases which have been transferred to homes for the aged or to private convalescent homes.

For the cases under the heading 3 the social factor naturally plays a role in so far as the kind of care – whether it is in their home, in a family, or in a private convalescent home – depends to a certain degree on the economic standard of the family.

4. *Patients who disappeared after discharge.* This group consists of cases which have, for example, disappeared to foreign countries and thus could not be followed, and those which could not be located for other reasons. The condition of these patients at the time of the discharge has been considered as final and the patients have then disappeared from the prognostic investigation in the same manner as the dead who naturally could only be observed until the time of their death.

5. *Cases of Remission.* In an investigation such as this, one naturally finds cases of remission which later were admitted to the hospital again and also those who after discharge got ill again. The information with regard to cases which we found in the hospital files refers, of course, also to the periods during which the patients have been discharged, in case they have later been readmitted. Thus, there is fairly complete information about these cases.

These cases are included in the material of the prognostic investigation just as the others, but are regarded as not permanently recovered as the report will show later. This group has furthermore been subjected to a special analysis with regard to the frequency of the remissions, the duration of illness etc.

Symptoms of the illness during the first month. For every new patient various data have been gathered, such as sex, age when taken ill, age of admittance to the hospital, external causes which are given as precipitating factors of the illness. The patients have

also been divided into groups according to the way the illness began, for instance, if the patient was taken ill acutely, subacutely, or gradually. The borderline for the acute onset of the illness has been set to 7 days at the utmost. If the illness has developed during not more than 2 months before the admittance to the hospital the cases have been counted as subacute; if over 2 months, as slowly developed.

Furthermore, the clinical symptoms which the patients have shown during the first month at the hospital have been gathered from the hospital files. In this procedure a rather comprehensive scheme of symptoms has been used. How these symptoms have been registered and brought together in larger groups will be seen in the chapter "Symptomatology". Here it may be remarked that, in case of the patients who were at the hospital before the start of the investigation or who were transferred from other hospitals, the symptoms have been registered from the records about the patient's condition during the first month.

The reason why data concerning symptoms have been collected only during the first month of the first period at the hospital is that they must refer to the same stage of the illness in order to be comparable. Naturally, it is of paramount interest to get a conception of how the illness presents itself in the beginning in order to be able to correlate the symptoms with the prognosis. The time of observation has been limited to one month because a longer time would have given room for variations in the picture of the illness itself. If a symptom had been found only for a small portion of a longer period, it would have been difficult to decide whether the symptom in question should or should not be regarded as existing. Such problems hardly play a role if the time of observation is only one month. The symptoms have, of course, been existing in more or less pronounced degree. It is also possible that some symptoms could have existed without having been registered. However, on the whole the records of the hospital have been quite detailed just at the beginning of the illness so that one has reason to regard the information as fairly reliable. No attention has been given to the question of whether a symptom was present in a more or less pronounced form. This would have made the data too detailed.

Finally it must be pointed out that certain factors which might have importance for the course of the illness could not be subjected to investigation. Among these is, for instance, the occurrence of

mental illness in the family. Such information is too uncertain since it concerns an old material. Information of this kind must be collected in a special way, which has not been possible with this material.

General Prognosis.

For the prognostic investigation only material I has been included. The procedure which has been followed has been to find out for each year how many patients have been under observation and how many of these have recovered or so much improved during the year that their condition could be regarded as stable. In this manner the material has been put together for the first 10 years after the beginning of the illness. The material decreases during this time, first of all, because of death but also because some cases are no longer accessible to observation. The material has therefore not been used for computations for the following years, particularly since in many cases one needs further years of observation in order to pass judgment. Our criterion has been that the patients should have been normal or improved until the end of the 10 year period and not less than three years. Since most of them recover at the beginning of the illness and have been under observation considerably more than 10 years, it follows, that, as a rule, they have been normal for a much longer time. The median for the time that they have been recovered lies for women at 11 years and for men at 14. For a small number, however, a special problem has arisen. This concerns particularly those patients who have died. Patients, who have recovered and have died within three years or have no longer been accessible to observation have been counted unstably recovered. Cases who have been observed during more than half a year have been counted as having been observed during the whole year while, on the other hand, cases who were observed less than one half of the year in question have been counted as lost from the material at the beginning of the year. In order to avoid not to have too many cases of death in the material (with the limitation as to time of observation and the uncertainty of judgment which such cases involve), the computation has been limited to individuals under 50 years of age. For persons of higher age, a small part of the material, the risk of death is so great that it has been regarded as unadvisable to include them in computing the probability of recovery. Table 4 shows a survey of chances of recovery. The figures show that the prospects of recovery are greatest during the first year.

Table 4.

Probability of recovering from the 1st to the 10th year after the beginning of the illness for schizophrenics treated for the first time.

| | Number of years after beginning of the illness | | | | | | | | | |
|---|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Men: | | | | | | | | | | |
| Number of recovered persons | 44 | 5 | 1 | 3 | 1 | 1 | — | — | — | 1 |
| Number being ill at the beginning of the year | 293 | 225 | 222 | 218 | 214 | 213 | 211 | 211 | 211 | 211 |
| Probability of recovering in per cent | 15.0 | 2.2 | 0.5 | 1.4 | 0.5 | 0.5 | — | — | — | 0.5 |
| Women: | | | | | | | | | | |
| Number of recovered persons | 24 | 1 | — | 3 | 2 | 3 | — | — | 1 | 2 |
| Number being ill at the beginning of the year | 243 | 196 | 191 | 190 | 186 | 184 | 181 | 181 | 181 | 180 |
| Probability of recovering in per cent | 9.9 | 0.5 | — | 1.6 | 1.1 | 1.6 | — | — | 0.6 | 1.1 |

For men the prospects during this year amount to 15 % and for women the figure is a little above 9.5 %. The following year the likelihood for men to recover is slightly above 2 % and only $\frac{1}{2}$ % for women. In later years one or two persons may recover so that the probability sometimes is 0, sometimes $\frac{1}{2}$ or a little over 1 %. The material is not large enough to give figures which with such low frequencies significantly deviate from 0. Even if, after 2 years the chances of recovery in single years are small, it does not follow that this probability can be regarded as small, if several years are taken together. Before following such a procedure it may, however, be of interest to make a more thorough analysis of the first year of illness. Therefore, in table 5 the figures for the first year have been given separately for the first two quarters of the year and for the last half.

These figures show that the prospects of recovery for men are greatest during the first quarter of the year and that they then decline. For women the chances during the first quarter of the year are about half as great as during the second quarter which is a bit odd. This can, however, be due to random variation of the

Table 5.

Probability of recovering during the first quarter, the second quarter and the last half of the first year.

| | Months after beginning of the illness | | |
|---|---------------------------------------|-----|------|
| | 0-3 | 3-6 | 6-12 |
| Men: | | | |
| Number of recovered persons | 20 | 11 | 13 |
| Number being ill at the beginning of the year | 293 | 273 | 262 |
| Probability of recovering in per cent | 6.8 | 4.0 | 5.0 |
| Women: | | | |
| Number of recovered persons | 6 | 11 | 7 |
| Number being ill at the beginning of the year | 243 | 237 | 226 |
| Probability of recovering in per cent | 2.5 | 4.6 | 3.1 |

figures. It is, of course, also possible that the diagnosis schizophrenia is not so easily given in cases which rapidly recover. The clinical picture which combines the diagnosis schizophrenia with a relatively favorable prognosis is, as will later be shown, of such a type that the diagnosis schizophrenia is not so likely to be given for those patients who have the best chances, i. e. those who fall ill in an acute manner with emotional disturbances and clearly recognizable confusion. Cases of this type which rapidly recover do not easily give particularly good causes for the diagnosis schizophrenia. Acute states of disorder which at the time of the collection of the material were labelled confusion or the like should perhaps actually be regarded as schizophrenias. It may be unnecessary to emphasize that this means only a hypothetical consideration, that no proof whatever of its correctness will be given and that such a proof would probably be difficult to obtain. (A possibility of verification may, however, be found in genetical investigations which establish a connection.) In schizophrenia as well as in other diseases one should find very light cases. Such cases which have a very gradual development are on the borderline of the schizoid psychopaths and can therefore be recognized. The acute light cases are not easily recognized from a clinical point of view.

In order to show how the prospects of recovery diminish with

time it may be pointed out that, according to the table, during the last 5 years only one man out of 212 on the average and only 6 women out of 182 recovered. It should also be remarked that the material is of a fair size including all together 536 persons under 50 years of age who were observed at the onset of the disease and who were classified as "certain schizophrenia". A larger material would, of course, give more reliable figures and also possibilities for a more differentiated picture, but the general trend in the figures as well as the order of magnitude of the probabilities concerned can be regarded as established.

In order to get an opinion of the total prospects of recovery in a more reliable way the following computation has been made: Starting with 100 patients one computes how many can be expected to have recovered after the first year and up to the 10th, with the probabilities given in table 4. Cf. table 6.

Table 6.

Total probability of stable recovery or of improvement from the 1st up to the 10th year after the first admission.

| Number of years after onset of the illness | Calculated percentage number of recovered persons | |
|---|---|-------|
| | Men | Women |
| 1 | 15.0 | 9.9 |
| 2 | 16.9 | 10.4 |
| 3 | 17.3 | 10.4 |
| 4 | 18.5 | 11.8 |
| 5 | 18.9 | 12.8 |
| 6 | 19.3 | 14.2 |
| 7 | 19.3 | 14.2 |
| 8 | 19.3 | 14.2 |
| 9 | 19.3 | 14.7 |
| 10 | 19.7 | 15.6 |

In making these computations, one must remember that if a person has once permanently recovered he cannot recover again, which implies that the probabilities for recovery given in table 4 are always applied to the remaining number of patients. In this way we obtain a rising series of figures and it results that after 10 years 19.7 % of the men and 13.5 % of the women have recovered.

The prospects seem to be better for men than for women but the difference is not statistically significant. It is $6.2 \pm 3.2 \%$.

It is now of interest to obtain more differentiated figures for the total probability of improvement or stable recovery. The material has therefore been fractionated partly with respect to age, partly with respect to the type of the onset of the disease. We have furthermore computed the percentage of patients who have totally recovered or improved 10 years after the beginning of the illness. To be sure, the figures which have been obtained are based on a small material but the resulting differences are rather large. Cf. table 7.

As has already been mentioned, the prospects seem to be better for men than for women even though the difference is not significant. Furthermore one finds that throughout the prospects are better for those who fall ill acutely or subacutely and less good in cases in which the disease develops slowly. (Concerning the boundaries between acute, subacute and slowly developing cases, we refer to chapter "Material".) Furthermore the figures seem to show that the prospects are better for men who fall ill after 30 years of age than for those who get the disease at an earlier age. This seems reasonable. A disposition to psychic disorder which is noticeable at an early age should, under otherwise similar conditions, be stronger than a disposition which shows first at a latter time. This fact is, however, not fully proved. The difference between those men who fall ill acutely or subacutely at the age from 30 to 50 and those at the same age who fall ill more gradually is $20.3 \pm 7.8 \%$ and is only statistically probable. On the other hand, the difference between those who fall ill acutely at the age of 30 to 50 and those who are gradually taken ill before 30 years of age is, however, statistically significant. This difference is $27.5 \pm 7.4 \%$. Finally, the difference between patients under 30 who fall ill acutely and the ones in the same age group whose illness develops gradually is statistically probable, since it amounts to $17.8 \pm 6.3 \%$. Other differences are not statistically significant. For women we find similar facts but, in regard to those who fall ill after 30 years of age the chances are less favorable than for those under 30. The difference between acute and subacute cases is, however, $9.2 \pm 7.8 \%$ and can thus be due to random variation. The difference for those who have gradually fallen ill is $8.5 \pm 5.8 \%$. The only difference in the table which is statistically significant is the difference between younger people who

Table 7.

Probability of stable recovery from the 1st up to the 10th year after the beginning of the illness. Distribution according to age and way in which the illness started.

| Way in which the illness started | Age, years | Number being ill at the beginning of the time of observation | Number of years after beginning of the illness | | | | | | | | | | |
|----------------------------------|------------|--|--|------|------|------|------|------|------|------|------|------|------|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| Acutely + subacutely | -30 | 61 | 23.0 | 26.3 | 26.3 | 26.3 | 26.3 | 26.3 | 26.3 | 26.3 | 26.3 | 26.3 | 26.3 |
| | | 50 | 26.0 | 30.0 | 30.0 | 34.0 | 34.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | |
| | -30 | 93 | 5.4 | 5.4 | 6.4 | 6.4 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 8.5 | |
| | | 30-50 | 89 | 13.5 | 14.6 | 14.6 | 15.7 | 15.7 | 15.7 | 15.7 | 15.7 | 15.7 | |
| Gradually | -30 | 60 | 20.0 | 21.7 | 21.7 | 21.7 | 23.3 | 23.3 | 23.3 | 23.3 | 25.0 | 26.7 | |
| | | 51 | 11.8 | 11.8 | 11.8 | 15.6 | 15.6 | 17.5 | 17.5 | 17.5 | 17.5 | 17.5 | |
| | -30 | 43 | 9.3 | 9.3 | 9.3 | 9.3 | 11.7 | 11.7 | 11.7 | 11.7 | 11.7 | 14.0 | |
| | | 30-50 | 89 | 2.2 | 2.2 | 2.2 | 3.3 | 3.3 | 5.5 | 5.5 | 5.5 | 5.5 | |

have fallen ill acutely and older ones whose illness has developed gradually. Here the difference is 21.2 ± 6.2 %. The material shows also variations of a similar kind as with men but without statistically significant differences. Generally the figures thus show that the prospects of recovery are far better for persons with an acute or subacute beginning of the disease than for those whose illness has developed gradually. With regard to the different age groups the variations are not unambiguous. On the whole the chances for men whose illness started at a later age seem to be better than for those who fell ill at an earlier age. For the women the chances are in opposite direction but the differences are small. A larger material is needed in order to obtain reliable conclusions with regard to this point. As has been mentioned before, one should rather expect that those who had fallen ill at an earlier age should have a less favorable prognosis.

It now remains to try to get an opinion concerning the occurrence of remissions. In this connection the cases which have been counted as cases of remission are those which have had at least one period of recovery or improvement after their first admission to the hospital. In addition, those patients have been included in this group who have improved or recovered but who have died within 3 years. These two groups have been regarded as unstably improved. One cannot, of course, be sure that those patients who have died had recovered for good, since one does not know whether relapses would have occurred if the patient had stayed alive. In comparison with those who have recovered or are improved these unstably improved belong to a less favorable group, although the course of their illness is more favorable than that of the patients who are continually ill since their first admission. Table 8 shows figures for the probability of such unstable improvements. It turns out that in most cases such improvement happens during the first quarter of the year and then decreases continually for men as well as for women. During the following years there is still some probability of remissions, but after 5 years the prospects for a first remission are very small. (Only in one woman has such a remission been observed.)

In table 9 we have computed for both men and women the total probability of recovery or improvement in a more or less stable way, based upon the distances from the beginning of the disease. It turns out that, as has been pointed out before, after 10 years 19.7 % of the men are stably recovered or improved and 13.5 %

Table 8.

Probability of remission from 1 up to 10 years after the beginning of the illness.

| Years after beginning of the illness | Men | | | Women | | |
|--------------------------------------|--------------------|--------------------|-----|--------------------|--------------------|-----|
| | Total no. of cases | Cases of remission | % | Total no. of cases | Cases of remission | % |
| 1 | 293 | 24 | 8.2 | 243 | 23 | 9.5 |
| 2 | 225 | 9 | 4.0 | 198 | 4 | 2.0 |
| 3 | 211 | 2 | 0.9 | 193 | 1 | 0.5 |
| 4 | 208 | 1 | 0.5 | 192 | 1 | 0.5 |
| 5 | — | — | — | — | — | — |
| 6 | 203 | 1 | 0.5 | — | — | — |
| 7 | — | — | — | — | — | — |
| 8 | — | — | — | — | — | — |
| 9 | — | — | — | — | — | — |
| 10 | — | — | — | — | — | — |

Table 9.

Computed total probability in percent of recovery or improvement in a more or less stable way from 1 up to 10 years after the beginning of the illness.

| Number of years after beginning of the illness | Condition | | | | | |
|--|------------------|-------|--------------------|-------|-----------------|-------|
| | Stably recovered | | Unstably recovered | | Permanently ill | |
| | Men | Women | Men | Women | Men | Women |
| 1 | 15.0 | 9.9 | 8.2 | 9.5 | 76.8 | 80.6 |
| 2 | 16.9 | 10.4 | 11.9 | 11.5 | 71.2 | 78.3 |
| 3 | 17.3 | 10.4 | 12.7 | 11.7 | 70.0 | 77.9 |
| 4 | 18.5 | 11.8 | 13.1 | 12.1 | 68.4 | 76.1 |
| 5 | 18.9 | 12.8 | 13.1 | 12.1 | 68.0 | 75.1 |
| 6 | 19.3 | 14.2 | 13.5 | 12.1 | 67.2 | 73.7 |
| 7 | 19.3 | 14.2 | 13.5 | 12.1 | 67.2 | 73.7 |
| 8 | 19.3 | 14.2 | 13.5 | 12.1 | 67.2 | 73.7 |
| 9 | 19.3 | 14.7 | 13.5 | 12.1 | 67.2 | 73.2 |
| 10 | 19.7 | 15.6 | 13.5 | 12.1 | 66.8 | 72.3 |

unstably improved, i. e., together 33.2 %. The corresponding figures for women are 15.6 % stably and 12.1 % unstably improved, i. e., together 27.7 % with a rather favorable course of the illness. Thus, 66.8 % of the men and 72.3 % of the women are continually ill.

The figures shown so far have been computed on an empirical basis. In this procedure it has been possible to use also cases which have been under observation only part of the time. It should be remembered that the mortality for insane people during the time they are at the hospital is greater than for normal persons, as has been shown by *Malzberg* (1934) and *Alström* (1942), among others. One does not know whether there is a difference in mortality between mental patients who are chronically ill and those who have recovered after a shorter or longer time of illness. Taking into account the fact that the excessive mortality is greatest in earlier years and perhaps particularly during the first period of the disease those patients who recover are during a certain time also exposed to an increased risk of death. Even if there should be a difference as to risk of death between the patients who have recovered and those who continue to be ill, this should be of little relevance to an investigation of this character. Below will be found a survey of the material, which is based upon those cases which remained after 5 and 10 years respectively. Contrary to earlier tables, however, the figures of this table include persons over 50 years of age. It was regarded as the correct procedure to report on these also for the sake of completeness. Meanwhile, it should be emphasized that we are here concerned with a crossection of the material and that those who died before the 5th and 10th year respectively are not in any way included in these figures. We deal only with persons who are alive at these two periods after the beginning of the disease. Considering the influence of patients who have died, it should be remembered that if data are collected at a distance far from the beginning of the illness, misleading figures may be obtained. The fact that patients have died decreased the material. If the danger of death for those in the care of a hospital is greater than for persons who have recovered, too favorable figures are to be expected. 15-20 years after the beginning of the disease most of the patients may be dead but it is perhaps especially those who have recovered and improved who have survived. For this reason a relatively high percentage of recovered and improved is found among the surviving patients. Therefore the computed figures must give a more correct result than those obtained through direct observation. That is also the reason why persons over 50 years of age have been excluded from the earlier computation of the total chances. Now, since the distance in time is not longer than 10 years, one cannot expect too great a difference

between the computed and the observed figures. But, on the other hand, one cannot expect that the figures in the following and the earlier tables completely agree. This survey will, however, serve as a certain control, and it can be said to answer the question of what actually becomes of those patients who live until the end of the 5th and 10th years since the beginning of the disease.

At the end of the 5th year 263 men are under observation. Thus, 44 cases are no longer accessible. Cf. table 9. 55 cases, i. e., 20.9 % have permanently recovered – in these cases they have been normal during at least 5 years. 178 cases, i. e., 67.7 %, are chronically ill and 30, i. e., 11.4 %, represent types with remissions. Among those, 16 were ill and 14 temporarily normal at the end of the 5th year. However, these patients have had a period of improvement and at least another attack of illness. At the end of the 10th year, we find a small shift in the figures. The number of observed patients is 232, of whom 132, i. e. 65.5 %, are chronically ill, while 53, i. e., 22.8 %, are permanently recovered – one case of those, however, was observed as normal only during two years. The cases of remission are 27, of which 8 are normal and 19 ill at the end of the 10th year. Altogether 22.8 % are therefore permanently recovered, 11.6 % are cases of remission and 65.5 % chronically ill. Evidently these figures tally fairly well with the calculated figures. The reason for the difference is that in the earlier computations some cases which at the end of the 10-year-period were observed for a short time only were not counted as permanently recovered but rather had been regarded as recovered but in an unstable condition. However, these have not the character of remissions; it was therefore not regarded as correct to include them in this group in table 11.

For women a corresponding survey after 5 and 10 years has been given in tables 12 and 13. After 5 years 244 women remain and 32 are therefore no longer accessible. After 5 years the frequency of chronically ill is 74.6 %, of recovered or improved patients 14.9 %, and of cases of the remission type 11.4 %. After 10 years we find good agreement with the calculated figures. The number of recovered is 17.6 %, the number of chronically ill 70.5 %, and the cases of remission amount to 12.2 %. In the four tables showing the distribution of the material at the end of the 5th and 10th year, figures are also given concerning different age groups of patients whose illness has begun acutely and of those whose illness has begun gradually. Finally, not only the pure cases of schizophrenia have

Table 10.

Survey of the men in Material I (definite cases of schizophrenia and doubtful cases) at the end of the 5th year after the beginning of the illness.

| Group | Total num- ber | Acutely+subacutely | | | Gradually | | |
|-------|----------------------|--------------------|-------|-----|-----------|-------|-----|
| | | Age | | | Age | | |
| | | -30 | 30-50 | 50- | -30 | 30-50 | 50- |

Total number at the end of the 5th year :

| | | | | | | | |
|-------------------------------------|-----|----|----|---|----|----|----|
| Definite cases of schizophrenia = n | 263 | 51 | 43 | 4 | 80 | 77 | 8 |
| All cases = N | 305 | 59 | 51 | 4 | 95 | 86 | 10 |

Number chronically ill:

| | | | | | | | | |
|---------------------------|--------|------|------|------|---|------|------|------|
| Definite cases of schiz.: | Number | 178 | 25 | 20 | 4 | 67 | 54 | 8 |
| | % of n | 67.7 | 49.0 | 46.5 | — | 83.2 | 70.1 | — |
| All cases: | Number | 201 | 27 | 23 | 4 | 79 | 59 | 9 |
| | % of N | 65.9 | 45.8 | 45.1 | — | 83.2 | 68.6 | 90.0 |

Number recovered and improved:

| | | | | | | | | |
|---------------------------|--------|------|------|------|---|------|------|---|
| Definite cases of schiz.: | Number | 55 | 16 | 17 | — | 8 | 14 | — |
| | % of n | 20.9 | 31.4 | 39.5 | — | 10.0 | 18.2 | — |
| All cases: | Number | 61 | 18 | 20 | — | 8 | 15 | — |
| | % of N | 20.0 | 30.5 | 39.2 | — | 8.4 | 17.4 | — |

Distribution of the recovered:

| | | | | | | | | |
|--|----------------------|----|----|----|---|---|----|---|
| Stably recovered for at least 5 years | Def. cases of schiz. | 54 | 16 | 17 | — | 8 | 13 | — |
| | All cases | 60 | 18 | 20 | — | 8 | 14 | — |
| Stably recovered for at least 1 year | Def. cases of schiz. | 1 | — | — | — | — | 1 | — |
| | All cases | 1 | — | — | — | — | 1 | — |

Number with at least 1 remission :

| | | | | | | | | | | |
|--|---|-----------------------|--------|-----|------|------|-----|-----|-----|------|
| Ill at the end of the 5th year | { | Def. cases of schiz.: | Number | 16 | 5 | 1 | — | 4 | 6 | — |
| | | | % of n | 6.1 | 9.8 | 2.3 | — | 5.0 | 7.8 | — |
| | { | All cases: | Number | 21 | 7 | 2 | 9 | 5 | 7 | — |
| | | | % of N | 6.9 | 11.9 | 3.9 | 7.9 | 5.3 | 8.1 | — |
| Recovered at the end of the 5th year | { | Def. cases of schiz.: | Number | 14 | 5 | 5 | — | 1 | 3 | — |
| | | | % of n | 5.3 | 9.8 | 11.6 | — | 1.3 | 3.9 | — |
| | { | All cases: | Number | 22 | 7 | 6 | — | 3 | 5 | 1 |
| | | | % of N | 7.2 | 11.9 | 11.8 | — | 3.2 | 5.8 | 10.0 |

Table 11.

Survey of the men in Material I (definite cases of schizophrenia and doubtful cases)
at the end of the 10th year after the beginning of the illness

| Group | Total num- ber | Acutely + subacutely | | | Gradually | | |
|-------|----------------------|----------------------|-------|-----|-----------|-------|-----|
| | | Age | | | Age | | |
| | | -30 | 30-50 | 50- | -30 | 30-50 | 50- |

Total number at the end of the 10th year:

| | | | | | | | |
|-------------------------------------|-----|----|----|---|----|----|---|
| Definite cases of schizophrenia = n | 232 | 44 | 39 | 4 | 70 | 70 | 5 |
| All cases = N | 270 | 52 | 47 | 4 | 82 | 78 | 7 |

Number chronically ill:

| | | | | | | | | |
|---------------------------|--------|------|------|------|---|------|------|---|
| Definite cases of schiz.: | Number | 152 | 21 | 16 | 4 | 57 | 49 | 5 |
| | % of n | 65.5 | 47.7 | 41.0 | — | 81.4 | 70.0 | — |
| All cases: | Number | 173 | 23 | 19 | 4 | 68 | 53 | 6 |
| | % of N | 64.1 | 44.2 | 40.4 | — | 82.9 | 67.9 | — |

Number recovered and improved:

| | | | | | | | | |
|---------------------------|--------|------|------|------|---|------|------|---|
| Definite cases of schiz.: | Number | 53 | 14 | 17 | — | 9 | 13 | — |
| | % of n | 22.8 | 31.8 | 43.6 | — | 12.9 | 18.6 | — |
| All cases: | Number | 59 | 16 | 20 | — | 9 | 14 | — |
| | % of N | 21.9 | 30.8 | 42.6 | — | 11.0 | 17.9 | — |

Distribution of the recovered:

| | | | | | | | | |
|---|----------------------|----|----|----|---|---|----|---|
| Stably recovered for at least 10 years | Def. cases of schiz. | 44 | 13 | 14 | — | 5 | 12 | — |
| | All cases | 48 | 14 | 16 | — | 5 | 13 | — |
| Stably recovered for at least 2 years | Def. cases of schiz. | 8 | 1 | 3 | — | 3 | 1 | — |
| | All cases | 10 | 2 | 4 | — | 3 | 1 | — |

Number with at least 1 remission:

| | | | | | | | | | | |
|---|---|-----------------------|--------|-----|------|------|---|-----|-----|------|
| Ill at the end of the 10th year | { | Def. cases of schiz.: | Number | 19 | 5 | 4 | — | 4 | 6 | — |
| | | | % of n | 8.2 | 11.4 | 10.3 | — | 5.7 | 8.6 | — |
| | { | All cases: | Number | 25 | 8 | 5 | — | 5 | 7 | — |
| | | | % of N | 9.3 | 15.4 | 10.6 | — | 6.1 | 9.0 | — |
| Recovered at the end of the 10th year | { | Def. cases of schiz.: | Number | 8 | 4 | 2 | — | — | 2 | — |
| | | | % of n | 3.4 | 9.1 | 5.1 | — | — | 2.9 | — |
| | { | All cases: | Number | 13 | 5 | 3 | — | — | 4 | 1 |
| | | | % of N | 4.8 | 9.6 | 6.4 | — | — | 5.1 | 14.3 |

Table 12.

Survey of the women in Material I (definite cases of schizophrenia and doubtful cases) at the end of the 5th year after the beginning of the illness.

| Group | Total num- ber | Acutely+subacutely | | | Gradually | | |
|-------|----------------------|--------------------|-------|-----|-----------|-------|-----|
| | | Age | | | Age | | |
| | | -30 | 30-50 | 50- | -30 | 30-50 | 50- |

Total number at the end of the 5th year:

| | | | | | | | |
|-------------------------------------|-----|----|----|---|----|----|----|
| Definite cases of schizophrenia = n | 244 | 56 | 44 | 7 | 39 | 78 | 20 |
| All cases = N | 296 | 73 | 54 | 7 | 47 | 93 | 22 |

Number chronically ill:

| | | | | | | | | |
|---------------------------|--------|------|------|------|---|------|------|------|
| Definite cases of schiz.: | Number | 182 | 34 | 24 | 5 | 33 | 68 | 18 |
| | % of n | 74.6 | 60.7 | 54.5 | — | 84.6 | 87.2 | 90.0 |
| All cases: | Number | 205 | 40 | 27 | 5 | 35 | 79 | 19 |
| | % of N | 69.3 | 54.8 | 50.0 | — | 74.5 | 84.9 | 86.4 |

Number recovered and improved:

| | | | | | | | | |
|---------------------------|--------|------|------|------|---|------|-----|-----|
| Definite cases of schiz.: | Number | 34 | 14 | 9 | 2 | 5 | 3 | 1 |
| | % of n | 13.9 | 25.0 | 20.5 | — | 12.8 | 3.8 | 5.0 |
| All cases: | Number | 44 | 20 | 10 | 2 | 6 | 4 | 2 |
| | % of N | 14.9 | 27.4 | 18.5 | — | 12.8 | 4.3 | 9.1 |

Distribution of the recovered:

| | | | | | | | | |
|--|----------------------|----|----|---|---|---|---|---|
| Stably recovered for at least 5 years | Def. cases of schiz. | 32 | 14 | 7 | 2 | 5 | 3 | 1 |
| | All cases | 41 | 20 | 7 | 2 | 6 | 4 | 2 |
| Stably recovered for at least 1 years | Def. cases of schiz. | 2 | — | 2 | — | — | — | — |
| | All cases | 3 | — | 3 | — | — | — | — |

Number with at least 1 remission:

| | | | | | | | | | | |
|--|---|-----------------------|--------|-----|-----|------|---|-----|-----|-----|
| Recovered at the end of the 5th year | { | Def. cases of schiz.: | Number | 15 | 3 | 8 | — | — | 3 | 1 |
| | | | % of n | 6.1 | 5.4 | 18.2 | — | — | 3.8 | 5.0 |
| | { | All cases: | Number | 27 | 7 | 11 | — | 4 | 4 | 1 |
| | | | % of N | 9.1 | 9.6 | 20.4 | — | 8.5 | 4.3 | 4.5 |
| Recovered at the end of the 5th year | { | Def. cases of schiz.: | Number | 13 | 5 | 3 | — | 1 | 4 | — |
| | | | % of n | 5.3 | 8.9 | 6.8 | — | 2.6 | 5.1 | — |
| | { | All cases: | Number | 20 | 6 | 6 | — | 2 | 6 | — |
| | | | % of N | 6.8 | 8.2 | 11.1 | — | 4.3 | 6.5 | — |

Table 13.

Survey of the women in Material I (definite cases of schizophrenia and doubtful cases) at the end of the 10th year after the beginning of the illness.

| Group | Total num- ber | Acutely + subacutely | | | Gradually | | |
|-------|----------------------|----------------------|-------|-----|-----------|-------|-----|
| | | Age | | | Age | | |
| | | -30 | 30-50 | 50- | -30 | 30-50 | 50- |

Total number at the end of the 10th year:

| | | | | | | | |
|-------------------------------------|-----|----|----|---|----|----|----|
| Definite cases of schizophrenia = n | 222 | 54 | 38 | 6 | 39 | 71 | 20 |
| All cases = N | 268 | 70 | 48 | 6 | 41 | 81 | 22 |

Number chronically ill:

| | | | | | | | | |
|---------------------------|--------|------|------|------|---|------|------|------|
| Definite cases of schiz.: | Number | 156 | 30 | 18 | 4 | 26 | 60 | 18 |
| | % of n | 70.3 | 55.6 | 47.4 | — | 78.8 | 84.5 | 90.0 |
| All cases: | Number | 172 | 34 | 21 | 4 | 28 | 66 | 19 |
| | % of N | 64.2 | 48.6 | 43.8 | — | 68.3 | 81.5 | 86.4 |

Number recovered and improved:

| | | | | | | | | |
|---------------------------|--------|------|------|------|---|------|-----|-----|
| Definite cases of schiz.: | Number | 39 | 16 | 9 | 2 | 6 | 5 | 1 |
| | % of n | 17.6 | 29.6 | 23.7 | — | 18.2 | 7.0 | 5.0 |
| All cases: | Number | 50 | 23 | 10 | 2 | 7 | 6 | 2 |
| | % of N | 18.7 | 32.9 | 20.8 | — | 17.1 | 7.4 | 9.1 |

Distribution of the recovered:

| | | | | | | | | |
|---|----------------------|----|----|---|---|---|---|---|
| Stably recovered for at least 10 years | Def. cases of schiz. | 34 | 15 | 7 | 2 | 4 | 5 | 1 |
| | All cases | 39 | 18 | 8 | — | 5 | 6 | 2 |
| Stably recovered for at least 2 years | Def. cases of schiz. | 2 | 1 | — | — | 1 | — | — |
| | All cases | 5 | 4 | — | — | 1 | — | — |

Number with at least 1 remission:

| | | | | | | | | | | |
|---|---|-----------------------|--------|------|------|------|---|-----|-----|-----|
| Ill at the end of the 10th year | { | Def. cases of schiz.: | Number | 22 | 6 | 10 | — | 1 | 4 | 1 |
| | | | % of n | 9.9 | 11.1 | 26.3 | — | 3.0 | 5.6 | 5.0 |
| | { | All cases: | Number | 36 | 10 | 14 | — | 4 | 7 | 1 |
| | | | % of N | 13.4 | 14.3 | 29.2 | — | 9.8 | 8.6 | 4.5 |
| Recovered at the end of the 10th year | { | Def. cases of schiz.: | Number | 5 | 2 | 1 | — | — | 2 | — |
| | | | % of n | 2.3 | 3.7 | 2.6 | — | — | 2.8 | — |
| | { | All cases: | Number | 10 | 3 | 3 | — | 2 | 2 | — |
| | | | % of N | 3.7 | 4.3 | 6.3 | — | 4.9 | 2.5 | — |

been included but also the group for which the diagnosis has been somewhat uncertain. If we include this latter group we obtain a small shift in the figures which has very little interest. These figures, however, are given in order to show that the differences in the delimitation of the material, — whether one is quite severe with regard to the diagnostic requirements or less inclined to exclude doubtful cases —, have not a very great importance for the prognostic figures which one obtains. This could already have been predicted on the ground that the cases which one has reason to regard as uncertain are fairly few in number. Even though these cases do not follow the usual schizophrenic course, the deviations are not so strong as to have a serious significance from a statistical point of view. In conclusion it can thus be said that in general the chances are best for men who fall ill acutely or subacutely in the 30–50 year period and worse for women whose illness develops gradually. The age seems not to be of much importance in the case of women.

The figures which we have obtained cannot be compared with the figures from earlier investigations, which should be clear from the report which is given in the survey of the literature. The report shows that there are many authors who have obtained far lower as well as far higher and more favorable figures. Evidently, the deviations are caused by the different ways in which the material has been selected. It must, of course, happen that some authors have also obtained figures which agree with the ones given here since the figures of recovered and improved patients vary from 5 % to 60 %.

In the survey of the literature a rather severe criticism has been directed against earlier investigations. For this reason the author has found it necessary to support this criticism by showing on the basis of his own material how misleading figures can be if the material consists of cases which have been admitted for the first time as well as all other cases. In order to make use of a larger material in the investigation of the symptomatology and questions connected with it, other cases have also been included, as has been mentioned before, cases which at an earlier date had been admitted to Långbro hospital and which had remained during the period when the material was gathered. To these were also added cases which, it is true, had been admitted during the period of investigation but which had been cared for before in other hospitals. Thus, this material consists of a selection of cases which have a bad prognosis or, more correctly, very few cases which have recovered are included. If material II

is added to material I, which consists of cases admitted for the first time, one has a material of 1182 patients who are surely schizophrenics. Of these, 1168 have been observed for at least 10 years. A special analysis has now been made and in table 14 figures are given which show the result of a survey of the conditions at the end of the 10th year. Only cases with a clear diagnosis are included in the table. According to the figures, only 13.9 % are fully recovered.

Table 14.

Distribution of Material I and Material II (definite cases of schizophrenia) at the end of the 10th year after the beginning of the illness.

| | Men | Women |
|---------------------------------------|------|-------|
| Observed cases = N | 582 | 586 |
| Permanently ill cases | 334 | 346 |
| % of N | 57.4 | 59.0 |
| Stably recovered cases | 81 | 54 |
| % of N | 13.9 | 9.2 |
| Distribution of the recovered cases: | | |
| Recovered during at least 10 years | 81 | 54 |
| Recovered during more than 2 years | 37 | 28 |
| Recovered during less than 2 years | 5 | 6 |
| Cases of remission: | | |
| Ill at the end of the 10th year | 104 | 113 |
| % of N | 17.9 | 19.3 |
| Recovered at the end of the 10th year | 63 | 73 |
| % of N | 10.8 | 12.5 |

The cases of remission constitute not less than 28.7 % and the permanently ill amount to 57.4 %. This means that compared with material I, material II consists to a much greater extent of cases of remission and of permanently ill patients, and that fully recovered patients are, in comparison, not adequately represented. For the women we find similar figures. Those who have recovered or improved are only 9.2 %, the cases of remission 31.8 %, and the permanently ill 59 %. The tables which are here reproduced give less detailed information, but the figures just quoted can be compared with corresponding figures in table 11 and 13. Thus there is no doubt that the results must be thoroughly misleading when cases which have fallen ill for the first time are included together with other

cases. In this connection one must bear in mind that those schizophrenics who have remained at Långbro hospital constitute a selection inasmuch as more chronic cases of schizophrenia have been transferred to other hospitals before and during the period of the investigation. As a result of this, the additional cases of material II consist to a large extent of cases of remission.

The character of the permanently ill. In order to obtain a clearer conception of the character of the last stages of the chronically ill, the clinical character of the patients at the time of the last observation has been investigated. The patients – both of material I and II – subjected to this investigation had been chronically ill for at least 10 years. For the most part this last observation occurred much later than 10 years (up to 25 years) after the onset of the illness. Here the author has been satisfied with a comparatively rough grouping. The cases have been divided into persons who are predominantly catatonic, predominantly paranoid, and predominantly dement. The result of this survey is shown in table 15.

Table 15.

Character of the last stage in patients who have been permanently ill for at least 10 years. P = percent

| Character of the last stage | Men | | Women | |
|-----------------------------|--------|------------------------|--------|------------------------|
| | Number | P \pm ϵ (P) | Number | P \pm ϵ (P) |
| Catatonic | 120 | 43.5 \pm 3.0 | 89 | 31.6 \pm 2.8 |
| Paranoid | 69 | 25.0 \pm 2.6 | 75 | 26.6 \pm 2.6 |
| Dement | 87 | 31.5 \pm 2.8 | 118 | 41.8 \pm 2.9 |
| Total number | 276 | 100.0 | 282 | 100.0 |

Among the men a little more than 40 % of the permanently ill end in a catatonic condition. Slightly more than 30 % become more or less dement, and for 25 % the paranoid symptoms are predominant. For women we have a more or less corresponding distribution. The tendency toward a paranoid type is about equally strong. However, the relation is the reverse between the catatonic condition and dementia. This seems plausible inasmuch as, at the

beginning of the disease women show to a greater extent emotional disturbances and the tendency here under consideration is to a certain extent to be regarded as a development toward emotional dullness. The difference between men and women is, however, not statistically significant; but it is statistically probable. The difference in the frequency in the final stage with dementia as the essential symptom is 10.3 ± 4.0 %.

The character of the cases of remission. It remains to discuss the character of the cases of remission. In table 16 figures are now given from the materials taken together which give an orientation of

Table 16.

Frequency of repeated remissions among cases from Material I and Material II who have had at least 1 remission.

| Number of remissions | Men | | Women | |
|----------------------|--------|----------------------|--------|----------------------|
| | Number | % of preceding group | Number | % of preceding group |
| At least 1 | 154 | | 172 | |
| „ 2 | 104 | 67.5 | 100 | 58.1 |
| „ 3 | 70 | 67.3 | 45 | 45.0 |
| „ 4 | 40 | 57.1 | 21 | 46.7 |
| „ 5 | 24 | 60.0 | 11 | 52.4 |
| „ 6 | 16 | 66.7 | 5 | 45.5 |
| „ 7 | 10 | 62.5 | 4 | — |
| „ 8 | 7 | — | 3 | — |
| „ 9 | 4 | — | 3 | — |
| „ 10 | 1 | — | 1 | — |
| „ 11 | 1 | — | — | — |
| „ 12 | 1 | — | — | — |
| Number of cases | 154 | | 172 | |

the chances to get repeated remissions. The computation is made in such a way that the percentage of those with a remission who have had a second remission has been determined. After that the percentage of those who have had a third remission has been computed and so on. Thus, one has obtained figures which one after another show the probability of a new remission. The prospects of a repeated

remission decrease successively although not to a considerable degree. Of the men who have had a first remission 67 % have had another period of improvement and a new relapse. Of those who have had a 6th remission 63 % have a 7th one in the same way. Also for the women a corresponding trend in the figures is observed. On the whole the probability of new remissions seems to be greater for men than for women. The more remissions a patient has had, the less pronounced is the tendency toward more remissions. Incidentally, this can also be seen from the hospital records inasmuch as one gets the impression that the periods of improvement involve more and more limited improvements. From a clinical point of view it is, however, of interest to see that within the group diagnosed as schizophrenics there is a fairly large number of cases with a clear periodicity in the disease.

In order to demonstrate the character of the periodicity of these cases, we shall in the following give figures for the length of the various periods. In this procedure we distinguish between men and women and between material I and II. It is of interest to give a special table for material I separately, since it is this material which has been used for the prognostic investigation. In table 17

Table 17.

Cases of remission. Length of the periods of illness for women in Material I.

| Length of the periods | Number of periods of illness | | | | |
|-----------------------|------------------------------|-----------|-----------|---|-------------|
| | 1 | 2 | 3 | 4 | more than 4 |
| 0-2 months | 14 | 9 | 1 | — | — |
| 3-5 months | 11 | 5 | 3 | 1 | 1 |
| 6-8 months | 11 | 5 | — | — | — |
| 9-11 months | 6 | 2 | 2 | — | — |
| 1-2 years | 8 | 4 | 1 | — | — |
| 2-3 years | 2 | 6 | 2 | 2 | — |
| 3-4 years | 2 | 3 | 2 | — | — |
| 4-5 years | — | 1 | — | 1 | — |
| more than 5 years | 3 | 22 | 7 | 3 | — |
| Total | 57 | 57 | 18 | 7 | 1 |
| Median | 6.6 months | 2.7 years | 3.3 years | — | — |

figures for women with remissions in material I are given. They show that the periods of illness are comparatively short. For the first period of illness which precedes the first remission, the median is a little more than $\frac{1}{2}$ year. For the following periods the median keeps within 3 years. In table 18 corresponding figures for material II are given. The figures are here somewhat lower, but even so the

Table 18.

Cases of remission. Length of the periods of illness for women in Material II.

| Length of the periods | Number of periods of illness | | | | | | |
|-----------------------|------------------------------|-----------|------------|-----------|------------|---|-------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | more than 6 |
| 0-2 months | 21 | 13 | 7 | 5 | 3 | 2 | 2 |
| 3-5 months | 36 | 20 | 13 | 3 | 5 | 2 | 6 |
| 6-8 months | 15 | 9 | 8 | 5 | 1 | 1 | 3 |
| 9-11 months | 12 | 6 | 5 | 1 | — | — | — |
| 1-2 years | 16 | 15 | 6 | 2 | 1 | — | 1 |
| 2-3 years | 6 | 7 | 2 | 3 | 1 | 1 | — |
| 3-4 years | 1 | 3 | — | 1 | 1 | 1 | 1 |
| 4-5 years | 2 | 3 | — | — | — | — | — |
| more than 5 years | 6 | 39 | 16 | 10 | 2 | 2 | 1 |
| Total | 115 | 115 | 57 | 30 | 14 | 9 | 14 |
| Median | 5.7 months | 1.7 years | 8.2 months | 1.8 years | 5.2 months | — | — |

median for the first period is not quite $\frac{1}{2}$ year. For the following periods the figures are 1 to 2 years. Corresponding figures for men are given in table 19. The median for the first period of illness in material I is a little more than $\frac{1}{2}$ year and for the following periods the median lies in the neighbourhood of 1 year. From table 20 which gives figures for men in material II it is evident that the figures are lower for men than for women. The first period of illness before the first remission has a median of 3 months and for the following periods the median lies between $\frac{1}{2}$ and a whole year.

We will now try to obtain a conception of the intervals of normality. Figures for men in material I and II are given in tables 21 och 22. They show that the first period of normality is considerably longer than the first period of illness. The median for the first

Table 19.

Cases of remission. Length of the periods of illness for men in Material I.

| Length of the periods | Number of periods of illness | | | | |
|-----------------------|------------------------------|-----------|-----------|-------------|-------------|
| | 1 | 2 | 3 | 4 | more than 4 |
| 0-2 months | 11 | 11 | 5 | 3 | 6 |
| 3-5 „ | 12 | 7 | 1 | 1 | 2 |
| 6-8 „ | 6 | 1 | 1 | 1 | — |
| 9-11 „ | 4 | 6 | 1 | 1 | — |
| 1-2 years | 10 | 4 | 3 | 1 | — |
| 2-3 „ | 5 | 2 | 1 | 2 | — |
| 3-4 „ | 1 | 1 | 1 | — | 1 |
| 4-5 „ | — | 2 | — | — | — |
| more than 5 years | 2 | 17 | 4 | 2 | 1 |
| Total | 51 | 51 | 17 | 11 | 10 |
| Median | 7.0 months | 1.2 years | 1.3 years | 11.5 months | 2.8 months |

Table 20.

Cases of remission. Length of the periods of illness for men in Material II.

[illegible]

Table 21.

Cases of remission. Length of normal intervals for men in Material I.

| Length of the intervals | Number of normal intervals | | | | |
|-------------------------|----------------------------|-----------|--------|---|-------------|
| | 1 | 2 | 3 | 4 | more than 4 |
| -1 years | 6 | 11 | 7 | 3 | 6 |
| 1-2 " | 8 | 3 | 2 | 3 | — |
| 2-3 " | 7 | 1 | — | 1 | 1 |
| 3-4 " | 10 | 1 | 1 | — | — |
| 4-5 " | 5 | — | 1 | — | — |
| 5-6 " | 5 | 2 | 1 | — | — |
| 6-7 " | 1 | 1 | — | — | — |
| 7-8 " | 3 | 1 | — | — | — |
| 8-9 " | 3 | 1 | — | — | 1 |
| 9-10 " | — | 1 | — | — | — |
| 10- | 3 | 3 | 1 | 1 | — |
| Total | 51 | 25 | 13 | 8 | 8 |
| Median | 4.0 years | 1.7 years | 1 year | — | — |

Table 22.

Cases of remission. Length of normal intervals for men in Material II.

| Length of the intervals | Number of normal intervals | | | | | | | |
|-------------------------|----------------------------|-----------|-----------|-----------|-----------|-----------|---|-------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | more than 7 |
| -1 years | 25 | 21 | 23 | 14 | 4 | 8 | 3 | 7 |
| 1-2 " | 20 | 18 | 13 | 8 | 7 | 1 | 6 | 2 |
| 2-3 " | 17 | 10 | 5 | 3 | 4 | 4 | — | 2 |
| 3-4 " | 9 | 8 | 3 | 2 | 3 | — | — | 1 |
| 4-5 " | 7 | 5 | 2 | 2 | — | — | — | 1 |
| 5-6 " | 3 | 1 | 4 | — | — | 1 | — | — |
| 6-7 " | 6 | 3 | 1 | — | — | — | — | — |
| 7-8 " | 2 | 2 | 2 | 2 | 1 | — | — | — |
| 8-9 " | 3 | 4 | — | 1 | — | — | — | — |
| 9-10 " | 4 | — | 1 | — | — | — | — | — |
| 10- | 7 | 7 | 3 | — | 1 | — | — | — |
| Total | 103 | 79 | 57 | 32 | 20 | 14 | 9 | 13 |
| Median | 2.4 years | 1.7 years | 1.5 years | 1.3 years | 1.9 years | 0.9 years | — | — |

remission in material I for women amounts to 3 years and in material II to $4\frac{1}{2}$ years. The median for the following remissions lies between 1 and 2 years both for material I and material II. For men we find corresponding figures in tables 23 och 24. In material I the median for the first remission is 4 years and for the following remissions a little more than 1 year. In material II the median for the first remission is not quite $2\frac{1}{2}$ years, and afterwards the median for the remissions keeps between 1 and 2 years. On the whole, one gets the impression from the figures that for the cases which have repeated remissions the time of improvement is a trifle longer than the time of illness. It should be pointed out, however, that in cases of improvement of patients with remissions it has not been possible to obtain as reliable criteria for a judgment as when it is the question of permanently recovered individuals. On the whole an improvement always means that the patient was discharged and was able to live outside the hospital, and that special care for him has not been regarded as necessary. In some cases the patient has been fully able to work but not in all, and it is probable, that, in many cases, the patients show slight symptoms of illness even during the remissions. Since there has been no possibility to investigate the patients, it is, however, impossible to reach a clearer definition of their condition. Thus, we can characterize the group of remission cases as those cases which to a certain extent are prognostically "good" and who at a relatively early stage reveal this character through an improvement. Most of the cases have only one or two periods of improvement, others have them repeatedly, and there are a not insignificant number of cases whose illness has a pronounced character of periodicity with up to about 10 remissions. In order to get a clearer conception of the course of the illness in these cases, the final stage of the patients has been investigated inasmuch as a survey has been made about the condition of the patients at the last observation. If the patient has been improved at the time (whether normal or still ill) it has further been investigated for how long this state has existed. Furthermore, the material has been divided into cases with more or less than 4 remissions in one group. The result of such a survey is shown in table 25.

One sees from this table that the group of patients who have had only 1 or 2 remissions is for the most part (82 %) ill at the last observation. With a greater number of remissions the frequency of those who are recovered at the last observation increases,

Table 23.

Cases of remission. Length of normal intervals for women in Material I.

| Length of the intervals | Number of normal intervals | | | |
|-------------------------|----------------------------|-----------|---|-------------|
| | 1 | 2 | 3 | more than 3 |
| -1 years | 10 | 10 | — | 2 |
| 1-2 " | 11 | 6 | 3 | — |
| 2-3 " | 9 | 2 | — | — |
| 3-4 " | 6 | 1 | 2 | 1 |
| 4-5 " | 5 | 2 | 1 | — |
| 5-6 " | 2 | — | 1 | — |
| 6-7 " | 3 | 4 | — | — |
| 7-8 " | 1 | — | — | — |
| 8-9 " | 4 | — | — | — |
| 9-10 " | 1 | 1 | — | — |
| 10- " | 5 | 2 | 1 | — |
| Total | 57 | 28 | 8 | 3 |
| Median | 2.9 years | 1.8 years | — | — |

Table 24.

Cases of remission. Length of normal intervals for women in Material II.

| Length of the intervals | Number of normal intervals | | | | | | |
|-------------------------|----------------------------|-----------|-----------|-----------|-----------|---|-------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | more than 6 |
| -1 years | 14 | 16 | 7 | 3 | 4 | 3 | 7 |
| 1-2 " | 20 | 18 | 13 | 5 | 4 | — | 3 |
| 2-3 " | 14 | 6 | 6 | 4 | 1 | — | 1 |
| 3-4 " | 10 | 6 | 2 | 1 | 1 | 1 | — |
| 4-5 " | 11 | 3 | 1 | 1 | 1 | — | — |
| 5-6 " | 13 | 3 | — | — | — | — | — |
| 6-7 " | 2 | 3 | — | 1 | — | — | — |
| 7-8 " | 6 | 2 | 2 | — | — | — | — |
| 8-9 " | 3 | 1 | — | 1 | — | 1 | — |
| 9-10 " | 5 | 1 | 2 | 1 | — | — | — |
| 10- " | 17 | 13 | 4 | 1 | — | — | — |
| Total | 115 | 72 | 37 | 18 | 11 | 5 | 11 |
| Median | 4.0 years | 2.8 years | 1.9 years | 2.4 years | 1.5 years | — | — |

Table 25.

Cases of remission distributed with regard to their condition at the last observation.

| Number of remissions | Number of cases | Ill | | Normal | |
|----------------------|-----------------|--------|------|--------|------|
| | | Number | % | Number | % |
| 1-2 | 211 | 173 | 82.0 | 38 | 18.0 |
| 3-4 | 80 | 49 | 61.3 | 31 | 38.7 |
| 4- | 35 | 17 | 48.6 | 18 | 51.4 |
| Total | 326 | 239 | 73.3 | 87 | 26.7 |

Table 26.

Cases of remission, distributed with regard to number of remissions, condition at the last observation and length of the time they have been ill or normal at this occasion.

| Duration, years | 1-2 remissions | | | | 3-4 remissions | | | | > 4 remissions | | | |
|-----------------|----------------|------|--------|------|----------------|------|--------|------|----------------|------|--------|------|
| | Ill | | Normal | | Ill | | Normal | | Ill | | Normal | |
| | M I | M II | M I | M II | M I | M II | M I | M II | M I | M II | M I | M II |
| Men: | | | | | | | | | | | | |
| 0-1 | 5 | 1 | — | 2 | — | 4 | — | 4 | — | 1 | 1 | 4 |
| 1-5 | 6 | 5 | 1 | — | 1 | 4 | 3 | 2 | 1 | 2 | 1 | 6 |
| 5-10 | 8 | 5 | 3 | 1 | 1 | 8 | — | 4 | — | 4 | 1 | 1 |
| 10-20 | 11 | 20 | 2 | 3 | 2 | 7 | 1 | 1 | — | 2 | — | — |
| 20- | 1 | 9 | 1 | — | — | 2 | 1 | 1 | — | — | — | — |
| Total | 31 | 40 | 7 | 6 | 4 | 25 | 5 | 12 | 1 | 9 | 3 | 11 |
| Median | 8.1 | 14.8 | — | — | — | 8.1 | — | 5.6 | — | — | — | 2.7 |
| Women: | | | | | | | | | | | | |
| 0-1 | 1 | 6 | — | 3 | 1 | 1 | 1 | 4 | — | 1 | — | 3 |
| 1-5 | 10 | 8 | 5 | 2 | 2 | 3 | 1 | — | — | 3 | — | 1 |
| 5-10 | 11 | 16 | 3 | 2 | 2 | 3 | — | 4 | — | 3 | — | — |
| 10-20 | 16 | 25 | 1 | 7 | — | 8 | 1 | 3 | — | — | — | — |
| 20- | 1 | 8 | 1 | 1 | — | — | — | — | — | — | — | — |
| Total | 39 | 63 | 10 | 15 | 5 | 15 | 3 | 11 | — | 7 | — | 4 |
| Median | 9.1 | 10.8 | 5.8 | 11.4 | — | 11.3 | — | 7.5 | — | — | — | — |

and among those who have had more than 4 remissions about one half were normal and the other half ill at the last observation.

In order to discover to what degree the condition stabilizes itself we give in table 26 figures for the length of time the persons in question have been normal or ill at the last observation. In doing so, we have distinguished material I and material II (material I is of particular interest, since the prognosis has been computed from this material). In the group with 1 or 2 remissions, where most of the cases are ill at the last observation, the duration of the illness is long. The median lies at 8 years for men and 9 years for women in material I. Corresponding figures in material II are 15 years and 11. This means that patients who have only had 1 or 2 remissions eventually become permanently ill in most cases. A smaller number improve or recover, however, and here also it is the matter of a stable final state which in most cases has existed for more than 5 years. In the group with 3 or 4 remissions we also find a tendency toward stabilization in material II. Most of those whose final state is that of illness have been ill for about 10 years. In the group which is headed toward improvement and which amounts to nearly 40 %, the majority has been normal for over 5 years. Finally, if we consider the group whose members have had 4 or more remissions, we find that the condition in which they are at the last observation – whether normal or ill – has existed for a relatively short time, in most cases only for a few years. As has been mentioned before, half of the group is ill, half is normal. This can best be interpreted in the following way: among schizophrenics of the remission type there are patients who have a pronounced periodicity and who do not reach a stable state either of illness or normality. For this reason their condition at the last observation can just as well be characterized by illness as by normality, and the last state is not of long duration.

Thus, we find all degrees among the cases of remission, from cases which, after a few remissions stabilize themselves and then mostly remain ill but can also recover, to cases whose illness has a pronounced cyclic course with up to 10 or more remissions. Even after the long periods of observation which are here considered, namely from 10 to 20 years, one can in these cases not speak of stabilization.

General symptomatology.

It is now of interest to try to obtain a conception of the symptomatology during the first month after the onset of the illness. Actually

one has very little reason to expect surprising results from a registering, which is never accurate so long as symptoms cannot be graded with regard to their intensity. The clinical picture of schizophrenia is, of course, quite well known. However, it may still be of interest to obtain a survey of the symptomatology during the first month. But the motive for this tabulation is, above all, the necessity to obtain points of comparison by which the connection between prognosis and clinical symptoms may be clarified.

Table 27.

Frequency of emotional disturbances during the first month among all the cases (Material I and Material II).

| Symptom | Number | | | Per cent | | |
|---------------------|--------|-------|------------|----------|-------|------------|
| | Men | Women | Both sexes | Men | Women | Both sexes |
| Euphoria | 10 | 11 | 21 | 1.4 | 1.6 | 1.5 |
| Exaltation | 88 | 152 | 240 | 12.6 | 21.7 | 17.2 |
| Ecstasy | 9 | 12 | 21 | 1.3 | 1.7 | 1.5 |
| Dysphoria | 7 | 6 | 13 | 1.0 | 0.9 | 0.9 |
| Depression | 129 | 210 | 339 | 18.5 | 30.0 | 24.3 |
| Anxiety | 11 | 32 | 43 | 1.6 | 4.6 | 3.1 |
| Unstable mood | 15 | 68 | 83 | 2.2 | 9.7 | 5.9 |
| Apathy | 113 | 76 | 189 | 16.2 | 10.9 | 13.5 |
| Dementia (dullness) | 34 | 47 | 81 | 4.9 | 6.7 | 5.8 |
| Autism | 109 | 91 | 200 | 15.7 | 13.0 | 14.3 |
| Number of cases | 696 | 699 | 1.395 | | | |

Table 27 shows a survey of the *emotional* disturbances. The grouping in the table is relatively detailed. The figures show that for men as well as for women depression is the most common symptom. If the term depression is used in a wider sense, anxiety and dysphoria can be included. Now, it is not possible simply to put together percentages for depression and for anxiety, since in several cases patients have had both symptoms. The added figures which are given below have therefore been corrected for such overlapping. To be sure, this leads to the consequence that the figures which are

given here in the text do not tally with the figures which one obtains from the table by addition. If we now count together depression, dysphoria, and anxiety we find that 32.9 % of the women show depression in different degrees. The corresponding figure for men is 20.4 %. The difference is 12.5 ± 2.3 % and is thus statistically significant. Shifts of emotional status in the opposite direction are also more common among women than among men. If we count together euphoria, exaltation, and ecstasy, 23.3 % of the women have disturbances of the manic type. Among men the corresponding figure is 15.2 %. The difference is 8.1 ± 2.1 % and is therefore again statistically significant. Unstable mood is also more frequent among women than among men. For the former the figure is 9.7 % and for the latter 2.2 %. Apathy can to a certain extent be regarded as a contrast to disturbances of depressive and manic type. Here one finds a higher frequency for men than for women. The difference is 5.3 ± 1.8 % and is as good as statistically significant.

A symptom which has a special interest is autism. One can, of course, debate, whether this complicated functional disturbance is to be counted among the affective disturbances. It seemed most adequate to proceed in this way and, after all, it makes little difference in what category the symptom is registered. In the whole material 15.7 % of the men and 13 % of the women have these symptoms. Some authorities believe that, in the absence of autism, the counting of a case as schizophrenia is dubious. There are different definitions of autism, and particularly in schizophrenia the autism may occur in very great variations, from a light absorption in one self, which can hardly be distinguished from daydreaming, to the state of absolute disengagement, where the patient lives in his own dreamworld, and where the only contact with the outside world consists in the taking of food, and other such biological necessities. In this connection it should be pointed out that autism can naturally have existed to a somewhat greater extent than has been noted, since mild forms could have escaped notice or recording. It is, however, not reasonable to assume that these mild forms are so frequent that the symptom can be expected to occur in 100 % of the cases.

Finally it should be mentioned that some patients whose illness started gradually, were regarded as mentally dulled at the time of admittance and were called hebephrenics. In other words, it is a question of a mild disturbance and not of a pronounced hebephrenia. Under all circumstances it is of interest that schizophrenic women

show emotional disturbances to a greater extent than do men, particularly since one knows that the manic-depressive type of mental illness is more common among women than among men.

Table 28.

Frequency of disturbances with regard to volition during the first month among all the cases (Material I and Material II).

| Symptom | Number | | | Per cent | | |
|----------------------|--------|-------|------------|----------|-------|------------|
| | Men | Women | Both sexes | Men | Women | Both sexes |
| Slight inhibition | 55 | 65 | 120 | 7.9 | 9.3 | 8.6 |
| Severe inhibition | 71 | 50 | 121 | 10.2 | 7.2 | 8.7 |
| Stupor | 136 | 133 | 269 | 19.5 | 19.0 | 19.3 |
| Mutism | 24 | 39 | 63 | 3.4 | 5.6 | 4.5 |
| Stereotypy | 43 | 54 | 97 | 6.2 | 7.7 | 7.0 |
| Negativism | 140 | 188 | 328 | 20.1 | 26.9 | 23.5 |
| Refusal to take food | 32 | 55 | 87 | 4.6 | 7.9 | 6.2 |
| Catatonia | 4 | 7 | 11 | 0.6 | 1.0 | 0.8 |
| Echo symptoms | 1 | — | 1 | 0.1 | — | 0.1 |
| Impulsivity | 94 | 91 | 185 | 13.5 | 13.0 | 13.3 |
| Hyperkinesia | 5 | 5 | 10 | 0.7 | 0.7 | 0.7 |
| Agitation | 13 | 12 | 25 | 1.9 | 1.7 | 1.8 |
| Number of cases | 696 | 699 | 1.395 | | | |

In table 28 a survey is given of the symptomatology concerning disturbances with regard to *volition*. First of all, it can be said that the figures for men and women are very much the same with the exception of negativism which is more frequent among women. In this respect there is a significant difference, i. e. 6.8 ± 2.3 %. Similarly the refusal to take food, which is a related symptom, shows a numerical difference in the same direction, even though the difference is not statistically significant. Incidentally, it should be mentioned that the most common symptoms in schizophrenia are negativism and stupor.

The similarity in the occurrence of the various symptoms among men and women is also obvious in the *ideational processes*. Table 29

Table 29.

Frequency of disturbances in the ideational processes during the first month among all the cases (Material I + II).

| Symptom | Number | | | Per cent | | |
|----------------------|--------|-------|------------|----------|-------|------------|
| | Men | Women | Both sexes | Men | Women | Both sexes |
| <i>Delusions of:</i> | | | | | | |
| hypnotic influence | 88 | 85 | 173 | 12.6 | 12.2 | 12.4 |
| persecution | 276 | 259 | 535 | 39.7 | 37.1 | 38.4 |
| reference | 139 | 143 | 282 | 20.0 | 20.5 | 20.2 |
| poisoning | 63 | 66 | 129 | 9.1 | 9.4 | 9.2 |
| physical influence | 62 | 80 | 142 | 8.9 | 11.4 | 10.2 |
| obsession | 3 | 1 | 4 | 0.4 | 0.1 | 0.3 |
| superiority | 75 | 51 | 126 | 10.8 | 7.3 | 9.0 |
| inferiority | 11 | 30 | 41 | 1.6 | 4.3 | 2.9 |
| hypochondriasis | 79 | 50 | 129 | 11.4 | 7.2 | 9.2 |
| religion | 28 | 22 | 50 | 4.0 | 3.1 | 3.6 |
| erotomania | 1 | 6 | 7 | 0.1 | 0.9 | 0.5 |

| | | | |
|-----------------|-----|-----|------|
| Number of cases | 696 | 699 | 1395 |
|-----------------|-----|-----|------|

shows that delusions of persecution are most common. These are found in 37.1 % of the women and 39.7 % of the men. The ideas of reference occur in about the same degree among both sexes, around 20 %. The ideas of hypnotic influence are also remarkably alike. They are present in a little more than 12 % of both sexes. The least common symptom is the idea of obsession which occurs in 0.3 % of the whole material. It is, of course, to be expected that such ideas should not be very frequent in modern times and in a material from a big city.

The disturbances of *orientation* are registered either as confusion or as a lesser degree of confusion, lack of clearness. Free from disturbances of orientation are 79.5 % of the women and 84.2 % of the men. (The difference is statistically not significant and can therefore be due to random variation.)

A particular interest is attached to the occurrence of *hallucinations*. Here one finds that, according to table 31, 27.2 % of the women and 26.9 % of the men are free from hallucinations. In this connection it should be kept in mind that we are here dealing with

Table 30.

Frequency of disturbances of orientation during the first month among all the cases
(Material I and Material II).

| Symptom | Number | | | Per cent | | |
|-------------------|--------|-------|---------------|----------|-------|---------------|
| | Men | Women | Both sexes | Men | Women | Both sexes |
| Normal | 586 | 556 | 1142 | 84.2 | 79.5 | 81.9 |
| Confused | 82 | 102 | 184 | 11.8 | 14.6 | 13.2 |
| Lacking clearness | 28 | 41 | 69 | 4.0 | 5.9 | 4.9 |
| Number of cases | 696 | 699 | 1395 | 100.0 | 100.0 | 100.0 |

Table 31.

Frequency of hallucinations during the first month among all the cases
(Material I and Material II).

| Symptom | Number | | | Per cent | | |
|--------------------|--------|-------|---------------|----------|-------|---------------|
| | Men | Women | Both sexes | Men | Women | Both sexes |
| Hallucin. of sound | 470 | 483 | 953 | 67.5 | 69.1 | 68.3 |
| „ „ smell | 37 | 36 | 73 | 5.3 | 5.2 | 5.2 |
| „ „ taste | 18 | 18 | 36 | 2.6 | 2.6 | 2.6 |
| „ „ sight | 50 | 77 | 127 | 7.2 | 11.0 | 9.1 |
| „ „ touch | 119 | 88 | 207 | 17.1 | 12.6 | 14.8 |
| No hallucinations | 187 | 190 | 377 | 26.9 | 27.2 | 27.0 |
| Number of cases | 696 | 699 | 1395 | 100.0 | 100.0 | 100.0 |

the symptoms in the first month. Auditory hallucinations are the most frequent symptoms. They occur in 69.1 % of the women and in 67.5 % of the men. There is a certain difference between men and women concerning the visual hallucinations which occur in 11.0 % of the women and only in 7.2 % of the men. The situation is the same in the case of the tactual hallucinations, the frequency of which is 17 % among the men and only 12.6 % among the women.

It must here be pointed out that one cannot derive from the above tables how many patients have one symptom, or another, or several. For all symptoms are registered singly, so that a patient who, for instance, has auditory hallucinations can also have tactual hallucinations or both. A table which could show such relationships would be extremely complicated and would mean a division in a great number of groups.

It has seemed desirable, however, to obtain a rough survey of the symptomatology by grouping symptoms into larger categories. In order to survey the field as a whole, the various symptoms have been brought together into 5 larger groups as follows: Emotional disturbances (E), where all the symptoms have been counted which are present in table 37 with exception of autism, apathy and hebephrenia; Catatonic symptoms (C), corresponding to the symptoms given in table 39; Disturbances in the ideational processes, generally paranoid symptoms (P), corresponding to those in table 38; Hallucinations (H), according to the different types given in table 41; Disturbances of orientation (O), among which have been counted confusion and lack of clearness, which are to be found in table 40.

Table 32.

Frequency of different groups of symptoms during the first month among all the cases (Material I and Material II).

| Groups of symptoms | Number | | Per cent | | Differences |
|--------------------|--------|-------|----------------|----------------|----------------|
| | Men | Women | Men | Women | |
| Emotional symptoms | 332 | 447 | 47.7 \pm 1.9 | 63.9 \pm 1.8 | 16.2 \pm 2.6 |
| Paranoid symptoms | 470 | 447 | 67.5 \pm 1.8 | 63.9 \pm 1.8 | — |
| Catatonic symptoms | 301 | 372 | 43.2 \pm 1.9 | 53.2 \pm 1.9 | 10.0 \pm 2.7 |
| Hallucinations | 508 | 496 | 73.0 \pm 1.7 | 71.0 \pm 1.7 | — |
| Confusion | 110 | 136 | 15.8 \pm 1.4 | 19.5 \pm 1.5 | 3.7 \pm 2.0 |
| Number of cases | 696 | 699 | | | |

Table 32 shows the occurrence of these larger groups of symptoms in the material. A glance at the table shows that hallucinations and, after them, paranoid symptoms, are the most common ones, almost equally so for men and women. Women have shown considerably

larger figures with regard to the emotional disturbances. The difference is $16.2 \pm 2.6\%$ and is thus statistically significant. For the catatonic symptoms, which are again most common among women, the difference is also significant ($10.0 \pm 2.7\%$). The disturbances as to orientation, i. e., the existence of more or less pronounced confusion, do not show a statistically significant difference between men and women.

One more factor which is of interest in this connection is the way in which the disease starts. As has been mentioned earlier, the material has been divided into three groups with regard to this topic. First, we have a group with a sudden onset of the illness. Here are counted the cases which, as has been ascertained, have fallen ill within a week before the admission to the hospital. Secondly, we have a group whose members have fallen ill subacutely. In this group have been included patients whose disease, according to available information, has begun during the month immediately before the admission. The third group, those who have fallen ill gradually, consists of cases whose illness has become manifest more slowly. In these cases one has been able to make sure that the gradual development of their illness did not start within the last two months before admission. It is evident that objections can be raised against this kind of grouping. It is, of course, possible that the illness of a patient who belongs to the group of acute cases can have started earlier with certain vague symptoms which were recognized neither by the patient nor by his relatives as signs of a beginning schizophrenia. With some patients whose illness has here been considered as having developed gradually it might have begun rather suddenly a long time ago, for instance, with a passing headache or the like. In single cases the data can thus not be regarded as absolutely reliable. There are, of course, some borderline patients, and it matters little whether one registers such cases in one or another group. There is no doubt that, on the average, the group with sudden onset of the illness distinguishes itself considerably from that with a subacute beginning of the illness, and there is a decided average difference between this group and the group of patients whose illness started slowly. In table 33 the material is given grouped according to the way in which the illness began.

It turns out that there is a fair agreement in the figures for both men and women. With the men the illness seems perhaps more often to start gradually, but the difference is not significant. On

Table 33.

Percentage distribution according to the way in which the illness started among the schizophrenics.

| Type of onset of the illness | Men | Women | Total |
|------------------------------|-------|-------|-------|
| Sudden onset | 11.1 | 13.4 | 12.3 |
| Subacute onset | 28.6 | 31.2 | 29.9 |
| Gradual onset | 60.3 | 55.4 | 57.8 |
| Total | 100.0 | 100.0 | 100.0 |

the whole, the figures show that a little more than half the material fall ill slowly. A little more than $\frac{1}{3}$ of the patients with a more sudden onset of the illness belong to the group with an acute or subacute beginning of the disease.

Symptomatology and Prognosis.

Since we have reported about the general prognosis and also have given a general survey of the symptomatology, we shall now proceed to the problem concerning the connection between the prognosis and the various clinical symptoms. Thus, the intention is to investigate whether one can draw some conclusion as to the prognosis from the age of the patient at the onset of the illness, from the type of the beginning of the illness, and from the clinical symptoms during the first month. This is a question of comparing various groups of patients with regard to the course of their illness, namely the cases with a favorable development, those with an unfavorable development, and the cases of remission. The intention is, therefore, to find out to what degree there is a symptomatological difference between these prognostically different groups of cases. From material I the following groups have been selected:

1. A group of unfavorable cases which have remained ill at least during 10 years;
2. A group of favorable cases which have recovered or improved within 5 years after the onset of the illness, and which have been observed at least 5 years after the discharge;

3. A group of cases of remission which have had at least 2 remissions and have fallen ill for the third time and have been observed for at least 10 years.

In order to obtain a larger material for the investigation, corresponding groups have also been selected from material II. The difference between material I and material II refers, of course, to the time of observation. On the average, the patients in material II have been observed for a longer time. Table 34 gives a survey of the time of observation. It turns out that the difference between the

Table 34.

Survey of the time of observation for the different groups.

1 = permanently ill, 2 = permanently recovered, 3 = cases of remission.
Material I and II.

| Group | | Material I | | | | | | Material II | | | | | |
|----------|-------------|------------|-------|-----|-------|-------|-----|-------------|-------|-----|-------|-------|-----|
| | | Men | | | Women | | | Men | | | Women | | |
| | | year | month | day | year | month | day | year | month | day | year | month | day |
| Group 1 | 1. Quartile | 11 | 7 | 5 | 12 | 3 | 15 | 14 | 4 | 26 | 13 | 10 | 15 |
| | Median | 14 | 9 | 15 | 16 | 3 | 5 | 17 | 3 | — | 18 | 7 | 15 |
| | 3. Quartile | 19 | 8 | 15 | 19 | 10 | 15 | 24 | — | 23 | 23 | 6 | 15 |
| Group 2 | 1. Quartile | 11 | 11 | 9 | 11 | 4 | 5 | 14 | 2 | 15 | 14 | 10 | — |
| | Median | 17 | 1 | — | 16 | 8 | 15 | 17 | 2 | 15 | 18 | 8 | — |
| | 3. Quartile | 20 | 2 | 23 | 20 | 7 | 15 | 19 | 9 | 15 | 19 | 8 | — |
| Group 3 | 1. Quartile | 13 | 6 | 9 | 11 | 6 | 9 | 14 | 5 | 23 | 15 | 1 | 23 |
| | Median | 18 | 8 | — | 17 | 5 | — | 22 | 2 | — | 19 | 11 | — |
| | 3. Quartile | 22 | 2 | 15 | 20 | 4 | 23 | 26 | 6 | 6 | 27 | 4 | 8 |
| Material | 1. Quartile | 11 | 7 | 25 | 11 | 9 | — | 14 | 5 | 3 | 14 | 7 | 23 |
| | Median | 15 | 5 | — | 16 | 2 | 27 | 18 | 1 | 8 | 18 | 11 | — |
| | 3. Quartile | 20 | — | 9 | 20 | — | 23 | 24 | 8 | 23 | 23 | 10 | 8 |

medians for both materials amounts to 2-3 years, which is not a very great difference. In material II this should result in a lowering of the age at the time of the onset of the illness. Since, however, the factor of selection does not have a more pronounced effect, it might be regarded as a justified procedure to combine in the following treatment the corresponding groups from both materials. Now,

Table 35

Age distribution in the different groups at the time of onset of the illness.

1 = permanently ill, 2 = permanently recovered, 3 = cases of remission.

Material I and II.

Material I.

| | Group | | | Total |
|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | |
| Men | | | | |
| 1 Quartile | 22.53 year | 24.38 year | 21.38 year | 22.52 year |
| Median | 26.65 year | 32.75 year | 28.25 year | 27.55 year |
| 3 Quartile | 33.19 year | 39.75 year | 37.75 year | 35.11 year |
| Women | | | | |
| 1 Quartile | 25.31 year | 19.8 year | 22.38 year | 23.4 year |
| Median | 33.2 year | 27.5 year | 29.0 year | 31.17 year |
| 3 Quartile | 44.94 year | 40.5 year | 37.15 year | 42.63 year |

Material II.

| | Group | | | Total |
|------------|------------|------------|------------|------------|
| | 1 | 2 | 3 | |
| Men | | | | |
| 1 Quartile | 22.5 year | 22.17 year | 19.25 year | 21.32 year |
| Median | 28.17 year | 31.0 year | 25.58 year | 27.06 year |
| 3 Quartile | 35.17 year | 43.5 year | 30.44 year | 34.75 year |
| Women | | | | |
| 1 Quartile | 26.68 year | 21.0 year | 19.04 year | 23.91 year |
| Median | 33.75 year | 29.5 year | 25.0 year | 30.33 year |
| 3 Quartile | 45.38 year | 44.0 year | 31.42 year | 40.25 year |

table 35 shows that the differences as to age which exist at the beginning of the disease are comparatively insignificant even if, on the whole, they lie in the expected direction. Consequently it can be considered as a justified procedure to combine the groups from material I and material II.

Table 36.

Length of hospitalization in the different groups.

1 = permanently ill, 2 = permanently recovered, 3 = cases of remission.

Material I and II.

| Group | | Material I | | | | | | Material II | | | | | |
|-------|-------------|------------|-------|-----|-------|-------|-----|-------------|-------|-----|-------|-------|-----|
| | | Men | | | Women | | | Men | | | Women | | |
| | | year | month | day | year | month | day | year | month | day | year | month | day |
| up 1 | 1. Quartile | 11 | 7 | 5 | 12 | — | — | 14 | — | 8 | 13 | 4 | 25 |
| | Median | 14 | 9 | — | 15 | 11 | 15 | 16 | 10 | 20 | 18 | — | 15 |
| | 3. Quartile | 19 | 6 | — | 19 | 9 | 15 | 23 | 6 | 23 | 22 | 11 | 15 |
| up 2 | 1. Quartile | — | 2 | 15 | — | 3 | 15 | — | 10 | 15 | — | 6 | — |
| | Median | — | 5 | 26 | — | 5 | 8 | 1 | 7 | 15 | 2 | — | 15 |
| | 3. Quartile | — | 11 | 4 | — | 10 | — | 3 | 1 | 15 | 4 | 5 | — |
| up 3 | 1. Quartile | 2 | 10 | 8 | 3 | 10 | 26 | 2 | 4 | 23 | 3 | 4 | 23 |
| | Median | 5 | 7 | — | 9 | 4 | — | 8 | 1 | — | 8 | 3 | 23 |
| | 3. Quartile | 13 | 8 | 23 | 14 | — | 23 | 14 | 7 | 8 | 14 | 9 | 8 |
| al | 1. Quartile | 2 | 9 | 23 | 7 | 1 | — | 10 | 1 | 23 | 10 | 10 | 28 |
| | Median | 11 | 7 | 23 | 12 | 9 | — | 14 | 9 | 10 | 15 | 8 | 8 |
| | 3. Quartile | 17 | 4 | 8 | 18 | 5 | 8 | 19 | 11 | 23 | 21 | 4 | 26 |

For the sake of characterizing the groups still further, table 36 gives the figures for the length of hospitalization for both materials. In this connection it is of less interest that the time at the hospital is slightly longer for the patients in material II than for those in material I. But it is striking that the time of illness is comparatively short for those who have recovered or improved. The median is a little more than 5 months in material I and about 2 years in material II for men and women. Furthermore, it is of interest that the hospitalization for the cases of remission is considerably longer than it is for those who have permanently recovered, but is also considerably shorter than for the permanently ill. It is almost in the middle of these two categories. The median in material II keeps at a little over 8 years and in material I at $5\frac{1}{2}$ for men and a little above 9 years for women. The fact that the hospitalization is very long for the selected groups of permanently ill is not very astonishing. That it is not always the same as the time of observation is, of

Table 37.

Occurrence of emotional disturbances during the first month in the different groups. 1 = permanently ill, 2 = permanently recovered, 3 = cases of remission. Material I and II.

| Symptom | Men | | | | | | Women | | | | | | Both sexes | | | | | | |
|---------------------|-----|-----------|-----------|------|-----------|-----------|-------|-----------|-----------|------|-----------|-----------|------------|-----------|-----------|------|-----------|-----------|-----|
| | 1 | | | 2 | | | 3 | | | 1 | | | 2 | | | 3 | | | |
| | n | % of N | % of N | n | % of N | % of N | n | % of N | % of N | n | % of N | % of N | n | % of N | % of N | n | % of N | % of N | |
| Euphoria | 5 | 1.6 | 1 | 1.4 | 1 | 0.8 | 5 | 1.6 | — | — | — | — | 10 | 1.6 | 1 | 0.9 | 1 | 0.4 | |
| Exaltation | 27 | 8.6 | 13 | 18.8 | 28 | 23.7 | 63 | 20.2 | 12 | 25.0 | 28 | 26.4 | 90 | 14.4 | 25 | 21.4 | 56 | 25.0 | |
| Ecstasy | 4 | 1.3 | 1 | 1.4 | 2 | 1.7 | 5 | 1.6 | — | — | — | 3 | 2.8 | 9 | 1.4 | 1 | 0.9 | 5 | 2.2 |
| Dysphoria | 3 | 1.0 | 1 | 1.4 | 1 | 0.8 | 4 | 1.3 | — | — | — | — | 7 | 1.1 | 1 | 0.9 | 1 | 0.4 | |
| Depression | 9 | 15.6 | 15 | 21.7 | 31 | 26.3 | 79 | 25.3 | 18 | 37.5 | 39 | 36.8 | 128 | 20.4 | 33 | 28.2 | 70 | 31.3 | |
| Anxiety | 5 | 1.6 | 2 | 2.9 | 3 | 2.5 | 10 | 3.2 | 1 | 2.1 | 5 | 4.7 | 15 | 2.4 | 3 | 2.6 | 8 | 3.6 | |
| Unstable mood | 10 | 3.2 | — | — | 3 | 2.5 | 22 | 7.1 | 6 | 12.5 | 12 | 11.3 | 32 | 5.1 | 6 | 5.1 | 15 | 6.7 | |
| Apathy | 49 | 15.6 | 18 | 26.1 | 9 | 7.6 | 38 | 12.2 | 4 | 8.3 | 4 | 3.8 | 87 | 13.9 | 22 | 18.8 | 13 | 5.8 | |
| Dementia | 18 | 5.7 | — | — | 4 | 3.4 | 27 | 8.7 | 1 | 2.1 | 2 | 1.9 | 45 | 7.2 | 1 | 0.9 | 6 | 2.7 | |
| Autism | 56 | 17.8 | 10 | 14.5 | 8 | 6.8 | 44 | 14.1 | 6 | 12.5 | 11 | 10.4 | 100 | 15.9 | 16 | 13.7 | 19 | 8.5 | |
| Total | | | | | | | | | | | | | | | | | | | |
| number of cases = N | 315 | | 69 | | 118 | | 312 | | 48 | | 106 | | 627 | | 117 | | 224 | | |

course, explained by the fact that some patients may have had periods of improvement after 10 years.

We shall now proceed to compare the groups with regard to the various symptoms which have been recorded during the first month. If we consider at first the *emotional* disturbances which are shown in table 37, we see that among the men the frequency of exaltation is greater in the group with the favorable development and still greater among the cases of remission. The difference between group 1 and 2 is $10.2 \pm 5.0 \%$ and is thus not significant. On the other hand the difference between group 1 and 3 is statistically significant, namely $15.1 \pm 4.2 \%$. Concerning cases of depression the difference is still smaller. The difference between group 1 and 3 is $10.7 \pm 4.5 \%$ and is therefore not significant either. Nor is the difference between group 1 and 2 statistically significant. Autism is considerably more frequent among the unfavorable cases than among the cases of remission; the difference is statistically significant ($11.0 \pm 3.2 \%$). With regard to apathy, the frequency is greatest in the group of favorable cases and smallest among the cases of remission. The difference between group 2 and 3 is $18.5 \pm 5.8 \%$ and is thus statistically significant.

Among women, exaltation is also more common in the two groups with favorable development, but there is no significant difference. Concerning cases of depression the difference between group 1 and group 2 is $12.2 \pm 7.4 \%$ and is therefore statistically not reliable. The difference between group 1 and groups 2 and 3 taken together is, however, statistically probable, namely $11.7 \pm 4.6 \%$. Finally, the frequency of apathy among women is greatest in the group with unfavorable development and smallest in the group with remissions. The difference between these groups is $8.4 \pm 2.6 \%$ and is thus statistically significant. On the whole, one can therefore say that both for men and for women exaltation and depression can be regarded as favorable symptoms in the prognosis.

It turns out that both for men and women the frequency of exaltation and depression taken together is 34.8% in the group with the unfavorable development while the frequency of these symptoms is 49.6% in favorable cases. The difference then is $14.8 \pm 5.0 \%$ and is statistically probable. It is also evident from the table that the cases of remission, among which these symptoms occur with a total frequency of 56.3% , differ in this respect from the group with an unfavorable development.

If we consider the disturbances in the ideational processes (table 38), it turns out that among men the symptoms are rather evenly distributed between the groups 1 and 2, while the symptoms have a lower frequency in the group of remissions. However, only the difference in the frequency of ideas of reference in groups 1 and 3 is significant; it is $10.9 \pm 3.6 \%$.

Among women one notes that, on the whole, the frequency of symptoms seems rather to be lower in the two groups of favorable cases. The ideas of reference are less frequent in groups 2 and 3 than in group 1, but the differences are not statistically significant. Delusions of persecution occur more often in the group of unfavorable cases. The difference between groups 1 and 3 is $21.6 \pm 4.9 \%$ and is thus statistically significant. Delusions which refer to physics are most frequent in the group of unfavorable cases. The difference between groups 1 and 3 is $11.9 \pm 2.4 \%$ and is statistically significant. On the other hand, hypochondriac delusions occur more frequently in the group of favorable cases than in the other groups, but there are no statistically significant differences. Delusions of inferiority are more frequent in the group of remissions than in the other groups. Altogether one can thus assert that for men disturbances in the ideational processes are not a symptom which allows a more definite prognosis. On the other hand, with regard to women delusions of being hypnotized and persecuted are unfavorable symptoms.

Concerning volition (table 39), stereotypy occurs in 8.3% in group 1, but only in 1.4% in group 2 among men. The difference is $6.9 \pm 2.1 \%$ and is therefore statistically significant. Negativism occurs in 27.9% in group 1, but only in 11.6% in group 2. The difference is $16.3 \pm 4.6 \%$ and is statistically significant. This is also the case with regard to the difference between groups 1 and 3 which is $21.2 \pm 3.4 \%$. Impulsiveness is much more frequent in the group of unfavorable cases. The difference between group 1 and group 2 is $14.3 \pm 3.6 \%$ and is thus statistically significant. On the whole, these symptoms occur less in the group of remissions than in the other groups.

With regard to the women, inhibition is more pronounced in the two groups of favorable cases. The difference between the recovered and improved and those who become chronically ill is $9.2 \pm 3.1 \%$ and is very nearly statistically significant. Stereotypy occurs in 8.0% in group 1 and in 1.9% in the group of remissions. The difference is 6.1 ± 2.0 and is statistically significant. Negativism oc-

Table 39.

Occurrence of disturbances in regard to volition during the first month in the different groups. 1 = permanently ill cases, 2 = stably recovered cases, 3 = cases of remission. Material I and Material II.

| Symptom | Men | | | | | | Women | | | | | | Both sexes | | | | | | | | | | | | | |
|----------------------|-----|-----------|---|----|-----------|---|-------|-----------|---|----|-----------|---|------------|-----------|---|----|-----------|---|-----|-----------|--|----|------|--|----|------|
| | n | % of N | 1 | n | % of N | 2 | n | % of N | 3 | n | % of N | 1 | n | % of N | 2 | n | % of N | 3 | n | % of N | | | | | | |
| Slight inhibition | 23 | 7.3 | | 6 | 8.7 | | 4 | 3.4 | | 16 | 5.1 | | 7 | 14.6 | | 15 | 14.2 | | 39 | 6.2 | | 13 | 11.1 | | 19 | 8.5 |
| Severe inhibition | 38 | 12.1 | | 9 | 13.0 | | 6 | 5.1 | | 33 | 10.6 | | 2 | 4.2 | | 6 | 5.7 | | 71 | 11.3 | | 11 | 9.4 | | 12 | 5.4 |
| Stupor | 67 | 21.3 | | 16 | 23.2 | | 14 | 11.9 | | 58 | 18.6 | | 9 | 18.7 | | 22 | 20.8 | | 125 | 19.9 | | 25 | 21.4 | | 36 | 16.1 |
| Mutism | 10 | 3.2 | | 4 | 5.8 | | 4 | 3.4 | | 18 | 5.8 | | 4 | 8.3 | | 4 | 3.8 | | 28 | 4.5 | | 8 | 6.8 | | 8 | 3.6 |
| Stereotypy | 26 | 8.3 | | 1 | 1.4 | | 4 | 3.4 | | 25 | 8.0 | | 6 | 12.5 | | 2 | 1.9 | | 51 | 8.1 | | 7 | 6.0 | | 6 | 2.7 |
| Negativism | 88 | 27.9 | | 8 | 11.6 | | 8 | 6.8 | | 79 | 25.3 | | 14 | 29.2 | | 17 | 16.0 | | 167 | 26.6 | | 22 | 18.8 | | 25 | 11.2 |
| Refusal to take food | 13 | 4.2 | | 2 | 2.9 | | 1 | 0.8 | | 25 | 8.0 | | 4 | 8.3 | | 6 | 5.7 | | 38 | 6.1 | | 6 | 5.1 | | 7 | 3.1 |
| Catatonia | 1 | 0.4 | | 1 | 1.4 | | 1 | 0.8 | | 3 | 1.0 | | 2 | 4.2 | | — | — | | 4 | 0.6 | | 3 | 2.6 | | 1 | 0.5 |
| Echo symptoms | — | — | | — | — | | — | — | | — | — | | — | — | | — | — | | — | — | | — | — | | — | — |
| Impulsivity | 63 | 20.1 | | 4 | 5.8 | | 5 | 4.2 | | 40 | 12.8 | | 7 | 14.6 | | 5 | 4.7 | | 103 | 16.4 | | 11 | 9.4 | | 10 | 4.5 |
| Hyperkinesia | 4 | 1.4 | | — | — | | — | — | | 2 | 0.6 | | — | — | | 1 | 0.9 | | 6 | 1.0 | | — | — | | 1 | 0.5 |
| Agitation | 6 | 2.0 | | 1 | 1.4 | | 2 | 1.7 | | 4 | 1.3 | | 1 | 2.1 | | 4 | 3.8 | | 10 | 1.6 | | 2 | 1.7 | | 6 | 2.7 |

Total

number of cases = N 315

69

118

48

106

627

117

224

curs to about the same degree, with the exception of the group of remissions, where the frequency is lower. Impulsiveness occurs to a lesser degree in the group of remissions than in the other groups. The difference between the chronically ill and the cases or remission is $8.1 \pm 2.8\%$ and is statistically probable. Altogether it can be said that negativism, stereotypy, and impulsiveness are unfavorable symptoms among the men. Among the women the differences are not so pronounced.

The disturbances in orientation (table 40) are on the whole not so common. If the figures concerning men and women are counted together, it turns out that confusion and lack of clearness, i. e., more or less pronounced disturbances in orientation, occur in 11.6% in the group of the unfavorable cases, in 23.1% in the favorable group, and in 27.7% in the group of remissions. The difference between the groups 1 and 2 is $11.6 \pm 4.1\%$ and is therefore statistically probable. Among the men confusion occurs in 5.7% in the unfavorable group, and in the group of remissions in 22.0% . The difference is $16.3 \pm 4.0\%$ and is statistically significant. Also between group 1, and groups 2 and 3 taken together, the difference is statistically significant ($12.5 \pm 3.1\%$). For women the corresponding differences are $20.3 \pm 4.6\%$ and $18.2 \pm 3.8\%$ respectively, both statistically significant. A disturbance in orientation can therefore be regarded as a favorable sign from the prognostical point of view, which is not the same as to regard the absence of a disturbance as an unfavorable indication.

Table 41 shows the frequency of hallucinations in the various groups. It shows above all that lack of hallucinations is rather common. In the group of remissions, hallucinations are not found in 39.8% of the men and not in 37.7% of the women. In the unfavorable group hallucinations are absent in 23.2% of the men and in 25.3% of the women. The difference for men between groups 1 and 3 is $16.6 \pm 5.1\%$ and is statistically significant. For women this difference is $13.4 \pm 5.3\%$ and is only statistically probable. For the men the difference between the unfavorable group and the two favorable groups taken together is also statistically significant, namely $13.2 \pm 4.2\%$. Auditory hallucinations are the most frequent symptom, but there is no difference between the groups 1 and 2. Concerning the other hallucinations, the tactual ones are, among men, more frequent in the unfavorable group than in the favorable. The difference between group 1 and groups 2 and 3 taken together is 9.0

Table 40.

Occurrence of disturbances of orientation during the first month in different groups. 1 = permanently ill, 2 = permanently recovered, 3 = cases of remission. Material I + II.

| Symptom | Men | | | | | | Women | | | | | | Both sexes | | | | | |
|---------------------|-----|--------|----|--------|-----|--------|-------|--------|----|--------|-----|--------|------------|--------|-----|--------|-----|--------|
| | 1 | | 2 | | 3 | | 1 | | 2 | | 3 | | 1 | | 2 | | 3 | |
| | n | % of N | n | % of N | n | % of N | n | % of N | n | % of N | n | % of N | n | % of N | n | % of N | n | % of N |
| Normal | 284 | 90.2 | 57 | 82.6 | 89 | 75.4 | 271 | 86.9 | 33 | 68.7 | 73 | 68.9 | 555 | 88.5 | 90 | 76.9 | 162 | 72.3 |
| Confused | 18 | 5.7 | 8 | 11.6 | 26 | 22.0 | 22 | 7.1 | 10 | 20.8 | 29 | 27.4 | 40 | 6.4 | 18 | 15.4 | 55 | 24.6 |
| Lacking clearness | 13 | 4.1 | 4 | 5.8 | 3 | 2.5 | 19 | 6.1 | 5 | 10.4 | 4 | 3.8 | 32 | 5.1 | 9 | 7.7 | 7 | 3.1 |
| Total | | | | | | | | | | | | | | | | | | |
| number of cases = N | 315 | | 69 | | 118 | | 312 | | 48 | | 106 | | 627 | | 117 | | 224 | |

Table 41.

Hallucinations in different groups during the first month. 1 = permanently ill, 2 = permanently recovered, 3 = cases of remission.
Material I + II.

| Symptom | Men | | | | | | Women | | | | | | Both sexes | | | | | |
|---------------------|------|------|----|------|-----|------|-------|------|----|------|-----|------|------------|------|-----|------|-----|------|
| | 1 | n | % | 2 | n | % | 3 | n | % | 1 | n | % | 2 | n | % | 3 | n | % |
| | of N | | | of N | | | of N | | | of N | | | of N | | | of N | | |
| Hallucination of: | | | | | | | | | | | | | | | | | | |
| sound | 226 | 71.7 | 45 | 65.2 | 67 | 56.8 | 226 | 72.4 | 34 | 70.8 | 63 | 59.4 | 452 | 72.1 | 79 | 67.5 | 130 | 58.0 |
| smell | 17 | 5.4 | 5 | 7.2 | 7 | 5.9 | 17 | 5.4 | 4 | 8.3 | 3 | 2.8 | 34 | 5.4 | 9 | 7.7 | 10 | 4.5 |
| taste | 7 | 2.2 | 3 | 4.3 | 2 | 1.7 | 6 | 1.9 | 2 | 4.2 | 1 | 0.9 | 13 | 2.1 | 5 | 4.3 | 3 | 1.3 |
| sight | 21 | 6.7 | 4 | 5.8 | 5 | 4.2 | 32 | 10.3 | 1 | 2.1 | 9 | 8.5 | 53 | 8.5 | 5 | 4.3 | 14 | 6.3 |
| touch | 72 | 22.9 | 9 | 13.0 | 17 | 14.4 | 43 | 13.8 | 4 | 8.3 | 7 | 6.6 | 115 | 18.3 | 13 | 11.1 | 24 | 10.7 |
| No hallucin. | 73 | 23.2 | 21 | 30.4 | 47 | 39.8 | 79 | 25.3 | 13 | 27.1 | 41 | 38.7 | 152 | 24.2 | 34 | 29.1 | 88 | 39.3 |
| Total | | | | | | | | | | | | | | | | | | |
| number of cases = N | 315 | | 69 | | 118 | | 312 | | 48 | | 106 | | 627 | | 117 | | 224 | |

$\pm 3.5\%$ and is thus statistically probable. For women the difference is not so pronounced. Summarizing one might say that, in both sexes, hallucinations occur to about the same degree in the favorable and in the unfavorable group. The absence of hallucinations is a favorable symptom with regard to the group of remissions.

It remains to compare the various groups with regard to the manner in which the patients fell ill. Table 42 shows immediately that a slow and gradual start of the illness is an unfavorable symptom for both sexes. More than half of the favorable cases fall ill in an acute or subacute manner. Among the unfavorable cases only $\frac{1}{3}$ fall ill acutely or subacutely. Among women this fact is still more pronounced.

From the above observations it is evident that a sudden onset of the illness and more or less pronounced signs of confusion and emotional disturbances in the direction of exaltation-depression are to be regarded as favorable symptoms in the prognosis. Favorable is also the lack of hallucinations. The occurrence of delusions of hypnotism and persecution, of negativism and impulsiveness are to be considered as rather unfavorable symptoms. This does, of course, not mean that the existence or absence of these symptoms must always occur together in a patient.

As to the age of the patient at the beginning of the illness, this is slightly higher among the male patients in the favorable group than in the unfavorable. The median is 31.8 years for the favorable group and 27 for the unfavorable. This indicates that, among men, an early onset of the disease would result in an unfavorable prognosis. The reverse is the case among women. The median for the favorable group is 33 and for the unfavorable group 28.6 years. The differences are, however, not significant.

In tables 43 and 44 the various symptoms are brought together into larger groups in the same way as in the chapter on general symptomatology. Moreover, the cases are grouped with regard to the way in which the illness started.

Among women, the emotional disturbances are more frequent in the favorable group and in the group of remissions. The difference between group 1 and groups 2 and 3 taken together is $13.1 \pm 4.6\%$ and therefore statistically probable. The reverse is the case with regard to the paranoid symptoms. These are most frequent in the group of unfavorable cases. The difference between group 1 and group 3 is $18.4 \pm 5.5\%$ and between group 1 and groups 2 and 3 taken together $16.7 \pm 4.8\%$, both statistically significant. Catatonic

Table 43.

Frequency of groups of symptoms among women distributed with regard to character of onset of the illness.

E = emotional disturbances, P = paranoid symptoms, K = catatonic symptoms,

H = hallucinations, M = disturbances of orientation.

1 = permanently ill, 2 = permanently recovered, 3 = cases of remission

N = total number of cases, n = cases with symptoms

| Group | All cases | | | Character of onset of the illness | | | | | |
|-------|-----------|-----|-----------|-----------------------------------|-----|-----------|---------|-----|-----------|
| | | | | Acute + subacute | | | Gradual | | |
| | N | n | in % of N | N | n | in % of N | N | n | in % of N |
| E | | | | | | | | | |
| 1 | 312 | 182 | 58.3 | 97 | 61 | 62.9 | 215 | 121 | 56.3 |
| 2 | 48 | 35 | 72.9 | 36 | 29 | 80.6 | 12 | 6 | 50.0 |
| 3 | 106 | 75 | 70.8 | 71 | 50 | 70.4 | 35 | 25 | 71.4 |
| Total | 466 | 292 | 62.7 | 204 | 140 | 68.6 | 262 | 152 | 58.0 |
| P | | | | | | | | | |
| 1 | 312 | 222 | 71.2 | 97 | 60 | 61.9 | 215 | 162 | 75.3 |
| 2 | 48 | 28 | 58.3 | 36 | 18 | 50.0 | 12 | 10 | 83.3 |
| 3 | 106 | 56 | 52.8 | 71 | 28 | 39.4 | 35 | 28 | 80.0 |
| Total | 466 | 306 | 65.7 | 204 | 106 | 52.0 | 262 | 200 | 76.3 |
| K | | | | | | | | | |
| 1 | 312 | 155 | 49.7 | 97 | 54 | 55.7 | 215 | 101 | 47.0 |
| 2 | 48 | 29 | 60.4 | 36 | 25 | 69.4 | 12 | 4 | 33.3 |
| 3 | 106 | 54 | 50.9 | 71 | 41 | 57.7 | 35 | 13 | 37.1 |
| Total | 466 | 238 | 51.1 | 204 | 120 | 58.8 | 262 | 118 | 45.0 |
| H | | | | | | | | | |
| 1 | 312 | 231 | 74.0 | 97 | 72 | 74.2 | 215 | 159 | 74.0 |
| 2 | 48 | 35 | 72.9 | 36 | 27 | 75.0 | 12 | 8 | 66.7 |
| 3 | 106 | 64 | 60.4 | 71 | 43 | 60.6 | 35 | 21 | 60.0 |
| Total | 466 | 330 | 70.8 | 204 | 142 | 69.6 | 262 | 188 | 71.8 |
| M | | | | | | | | | |
| 1 | 312 | 39 | 12.5 | 97 | 17 | 17.5 | 215 | 22 | 10.2 |
| 2 | 48 | 15 | 31.2 | 36 | 14 | 38.9 | 12 | 1 | 8.3 |
| 3 | 106 | 33 | 31.1 | 71 | 28 | 39.4 | 35 | 5 | 14.3 |
| Total | 466 | 87 | 18.7 | 204 | 59 | 28.9 | 262 | 28 | 10.7 |

Table 44.

Frequency of groups of symptoms among men distributed with regard to character of onset of the illness.

E = emotional disturbances, P = paranoid symptoms, K = catatonic symptoms, H = hallucinations, M = disturbances of orientation.

1 = permanently ill, 2 = permanently recovered, 3 = cases of remission

N = total number of cases, n = cases with symptoms.

| Group | All cases | | | Character of onset of the illness | | | | | |
|-------|-----------|-----|-----------|-----------------------------------|-----|-----------|---------|-----|-----------|
| | | | | Acute + subacute | | | Gradual | | |
| | N | n | in % of N | N | n | in % of N | N | n | in % of N |
| E | | | | | | | | | |
| 1 | 315 | 138 | 43.8 | 99 | 45 | 45.5 | 216 | 93 | 43.1 |
| 2 | 69 | 40 | 58.0 | 40 | 24 | 60.0 | 29 | 16 | 55.2 |
| 3 | 118 | 66 | 55.9 | 64 | 38 | 59.4 | 54 | 28 | 51.9 |
| Total | 502 | 244 | 48.6 | 203 | 107 | 52.7 | 299 | 137 | 45.8 |
| P | | | | | | | | | |
| 1 | 315 | 216 | 68.6 | 99 | 63 | 63.6 | 216 | 153 | 70.8 |
| 2 | 69 | 52 | 75.4 | 40 | 28 | 70.0 | 29 | 24 | 82.8 |
| 3 | 118 | 75 | 63.6 | 64 | 33 | 51.6 | 54 | 42 | 77.8 |
| Total | 502 | 343 | 68.3 | 203 | 124 | 61.1 | 299 | 219 | 73.2 |
| K | | | | | | | | | |
| 1 | 315 | 152 | 48.3 | 99 | 45 | 45.5 | 216 | 107 | 49.5 |
| 2 | 69 | 28 | 40.6 | 40 | 19 | 47.5 | 29 | 9 | 31.0 |
| 3 | 118 | 29 | 24.6 | 64 | 18 | 28.1 | 54 | 11 | 20.4 |
| Total | 502 | 209 | 41.6 | 203 | 82 | 40.4 | 299 | 127 | 42.5 |
| H | | | | | | | | | |
| 1 | 315 | 243 | 77.1 | 99 | 86 | 86.9 | 216 | 157 | 72.7 |
| 2 | 69 | 48 | 69.6 | 40 | 27 | 67.5 | 29 | 21 | 72.4 |
| 3 | 118 | 71 | 60.2 | 64 | 41 | 64.1 | 54 | 30 | 55.6 |
| Total | 502 | 362 | 72.1 | 203 | 154 | 75.9 | 299 | 208 | 69.6 |
| M | | | | | | | | | |
| 1 | 315 | 31 | 9.8 | 99 | 16 | 16.2 | 216 | 15 | 6.9 |
| 2 | 69 | 13 | 18.8 | 40 | 10 | 25.0 | 29 | 3 | 10.3 |
| 3 | 118 | 30 | 25.4 | 64 | 26 | 40.6 | 54 | 4 | 7.4 |
| Total | 502 | 74 | 14.7 | 203 | 52 | 25.6 | 299 | 22 | 7.4 |

symptoms and hallucinations do not show greater differences. However, hallucinations are more common in the unfavorable group. The difference between groups 1 and 3 is $13.6 \pm 5.4\%$ and is therefore statistically probable. On the other hand, the disturbances in orientation are much more predominant in the favorable group and in the group of remissions. The difference between these two groups and the unfavorable group is $18.7 \pm 4.2\%$ and is therefore statistically significant. The difference between groups 1 and 2 is $18.7 \pm 6.9\%$, which is statistically probable. The difference between groups 1 and 3 is $18.6 \pm 4.9\%$ and is therefore statistically significant. On the right side of the table the symptoms are placed in relation to the manner in which the illness began. In the group with the favorable cases no less than 80.6% fell ill suddenly with emotional disturbances, while only 50% of this group fell ill slowly with the same disturbances. Consequently the emotional disturbances are prognostically favorable in cases of acute onset of the illness but have less importance in cases of slowly developing illness. Concerning the paranoid symptoms, one finds that they are most frequent in the group of patients who fall ill gradually. The difference is $24.3 \pm 4.4\%$ and is thus statistically significant. For the favorable groups, the difference between the two types of initial development is $37.9 \pm 7.5\%$ and is therefore also statistically significant. Concerning catatonic symptoms, the difference between patients whose illness began suddenly and those whose illness started slowly is $25.5 \pm 8.4\%$ and for all taken together $13.8 \pm 4.6\%$; both are statistically significant. If, with regard to disturbances in orientation, one compares the groups where the illness started acutely or subacutely with the one where the illness began gradually, one finds a significant difference in group 3. The difference amounts to $18.2 \pm 3.7\%$. Cases of remission who suddenly fall ill have consequently disturbances in orientation to a higher degree than those whose illness started gradually. Among patients who have permanently recovered there are very few whose illness started gradually, which is the reason why a difference is not ascertained, but if one combines the permanently recovered and the cases of remission, i. e., groups 2 and 3, one still obtains a significant difference of $26.5 \pm 6.8\%$.

If we consider the figures for men, we find shifts in a similar direction as for women. With regard to emotional symptoms there is a probable difference between group 1 and groups 2 and 3 taken together which amounts to $12.9 \pm 4.6\%$. For the catatonic symp-

toms we also obtain a significant difference between groups 1 and 3 of $23.7 \pm 4.9\%$. If we combine groups 2 and 3, the difference between these groups and group 1 is also significant and amounts to $17.8 \pm 4.4\%$. Hallucinations also show significant deviations of $16.9 \pm 5.1\%$ between groups 1 and 3, and of $13.5 \pm 4.2\%$ between group 1 and groups 2 and 3 taken together. Finally we find with regard to disturbances in orientation a difference of $15.6 \pm 4.3\%$ between groups 1 and 3, which is significant. The same is the case with regard to the difference between group 1 and groups 2 and 3 taken together, which amounts to $13.2 \pm 3.5\%$. If we now consider the figures in connection with the way in which the illness started we find that for paranoid symptoms in groups 2 and 3 taken together there is a significant difference between cases whose illness started suddenly and those whose illness began gradually. The difference is $20.8 \pm 6.6\%$. Paranoid symptoms occur more frequently among those whose illness began gradually. The frequency of hallucinations also shows a difference inasmuch as there is, in group 1, a significant difference of $14.2 \pm 4.5\%$ between those with an acute onset of the illness and those with a gradual one. As to disturbances of orientation we find a low frequency among those with a gradual onset of the illness. For group 3 we find a significant difference which amounts to $33.2 \pm 7.1\%$. Disturbances in orientation are more frequent among those with an acute beginning of the illness. Also for the combined groups 2 and 3 there is a significant difference. This, however, is not the case in group 1.

After having studied the material in detail and having grouped symptoms of various combinations, the following points of view as to the prognosis can be given as a summary of the analysis. Patients with a favorable prognosis relatively often show emotional disturbances, especially of the type of exaltation-depression. Disturbances of orientation are also frequent. Paranoid symptoms seem to occur particularly often among men with a relatively favorable prognosis. Hallucinations are less common, even though these differences are less pronounced. Among women the tendency in regard to paranoid symptoms lies in the opposite direction. While such symptoms among men seem rather to be favorable, the reverse is the case among women. Catatonic symptoms also show a shift in the opposite direction among women. They seem to be more frequent among the relatively favorable cases, while, among men, they are more common among the unfavorable cases.

Summary.

A survey of the literature shows, that investigations concerning prognosis in the case of schizophrenia have so far been defective. They have been based on material which has been selected from different points of view. Perhaps the most serious mistake is that in investigations as to prognosis one has in many cases used as material both patients who were admitted for the first time and others who were under hospital treatment during a later stage of their illness, and whom one has traced back to the beginning of the illness. This latter group includes cases who have comparatively small prospects of improvement or recovery. Furthermore, from a statistical point of view, these investigations are less satisfactory because figures of risk have not been computed and, as a rule, because the given figures have not been referred to a precise time of observation after the beginning of the disease.

1. The author has collected information concerning patients admitted to hospital care for the *first* time during 1915–1929. This group has been referred to as material I and contains 397 men and 437 women. Furthermore, information has been gathered concerning patients at the hospital during 1915–1929 who had *not* been admitted to the hospital for the *first* time during this period. This group has been called material II and contains 357 men and 437 women. The patients have afterwards been followed until 1939–1940 by means of collecting information from hospitals and from various social institutions, etc. It has been possible to gather information about the condition of 1553 of these 1628 patients. Consequently, information could not be obtained for 75 patients. These are patients who have been discharged from the hospital and afterwards could not be traced.

2. Material I has first of all been used for an investigation as to the prognosis of schizophrenia. The probability of recovery has been computed for different years after the start of the disease and furthermore the *total* probability of recovery up to 10 years after the beginning of the illness has been determined. Moreover, the frequency has been computed for those cases which have had remissions or have recovered, and also for the permanently ill. It turns out that after 5 years 18.9 % of the men have recovered, 13.1 % have had remissions or have been normal for less than 3 years before they died, and 68 % are permanently ill. After 10 years the corresponding figures are 19.7 % recovered, 13.5 % cases of remission, and 66.8 % permanently ill. For women we find, after 5 years, 12.8 % stably recovered, 12.1 % instably recovered – i. e., these

persons have had remissions or were recovered for a short time and then died —, and 75 % permanently ill. Corresponding figures after 10 years are 15.6 % for the stably recovered, 12.1 % for the instably recovered, and 72.3 % for the permanently ill.

The prospects of recovery are greatest during the first year. A closer analysis as to the time just after the onset of the illness shows that the prospects for women are rather worse during the first quarter of the year than during the second, and worse during the second half year than during the second quarter of the year. For men we find continually decreasing figures from the first quarter of the year. In connection with these figures it should be pointed out that there is a possibility that certain cases of acute schizophrenia of short duration and rapid recovery may not be diagnosed as schizophrenia.

In addition, as a control of the calculated figures, statistics are given in particular tables for patients who are still living and have been observed for 5 and 10 years respectively after the beginning of the disease. These figures show good agreement with the calculated figures.

Finally, a computation has been made of the results which are obtained if material I and material II are combined. Through this combination a big group of cases are added to the material who have first been observed only some time after the start of the illness, and who therefore have less prospect of recovery. For this reason lower figures as to the prospect of recovery are obtained by combining the two groups. The prospect of recovery after 10 years is for men who have been observed and have lived for 10 years, 13.9 %, and for women, 9.2 %. This survey has been made in order to show the importance of the source of error which an incorrect manner of selection of material involves.

3. A particular investigation has been made as to the condition at the last observation of the patients who have been continually ill. Here a schematic division has been used with the result that the patients have been grouped into predominantly catatonic, predominantly paranoid, and predominantly hebephrenic cases. The figures show that these groups are of about the same size; however, patients with predominantly catatonic symptoms are a little more numerous than the two other groups. There seems to be no difference between men and women.

4. The character of the cases of remission has also been investigated. It has turned out that the probability of a new remission, if one has had one before, amounts to 50–60 % and that the periods when the patients have been able to live outside of the hospital are likely

to be longer than the periods of illness. Particularly the first remission is extensive in comparison with the first period of illness. The median for the first remission amounts to 3-4 years, while the median of the first period of illness keeps within half a year. Furthermore, it has turned out that a predominant number of cases with few remissions end in illness, while cases with many remissions (4 or more) are just as often ill as recovered at the last observation.

5. The symptoms which the patients have shown during the first month have been recorded throughout in accordance with a fairly detailed schema. Furthermore, the difference between men and women as to the symptomatology during the time of the onset of the illness has been investigated. In this connection we have been able to show that women have emotional disturbances to a greater extent than men, and that negativism is much more frequent among women than among men. Delusions of persecution were also more common among women than among men. A rough division has been made with regard to the symptomatology in emotional disturbances, in catatonic and paranoid symptoms, and in hallucinations and disturbances as to orientation.

6. Through special groupings it has been shown that the prognosis is influenced by the way in which the illness begins and by the age of the patient. Those patients whose illness started acutely have the best prognosis and among them the men have a better prognosis than the women. The prospects of continuing improvement or permanent recovery within 10 years is 36 % for the men at the age of 30-50 whose illness started acutely, and 5.5 % for the women at the age of 30-50 whose illness began gradually. This is thus a matter of reasonably important differences. In order to obtain still further criteria for a differential prognosis the symptomatology has been investigated among selected patients who were permanently ill, stably improved or recovered, and in cases of remission. The requirement has been made that the permanently ill shall have been ill for at least 10 years, the recovered to have been normal for at least 3 years. The majority of these patients, however, have been normal for a much longer time. It turns out that the patients who have recovered have shown emotional disturbances more frequently than the cases of remission or the permanently ill. This is also true of cases with disturbances of orientation (states of confusion). Negativism, however, is an unfavorable symptom, especially among men. Besides, figures have been obtained which indicate that paranoid symptoms among men are likely to be a favorable sign, while the contrary is true among women. Furthermore, catatonic symptoms seem to be

comparatively more frequent among women with a favorable prognosis, while among men no such shift can be proved. Hallucinations tend to occur somewhat more often among those with an unfavorable prognosis. Some other differences of a certain interest have also been found between the patients with various courses of the disease. (Cf. chapter Symptomatology and Prognosis).

Note by the editor.

For several years my friend Doctor Sven Stenberg collected information about these cases. The material was then statistically analysed at my institute, and Doctor Stenberg wrote a rather long paper about the results of this analysis for publication in Sweden. He suddenly died, however, and the paper was not published. When the paper now is published in English it has, however, been necessary to compress it. In cutting it down I have tried not to strike out any important information.

The paper should be of practical interest for judging the results of the new therapy against schizophrenia. It seems probable to me that the cases who have a fairly good prognosis should be more suitable to such treatment than others. When it is a question of so called psychogenic depression, for instance in a woman after the death of a child, shock therapy is very successful. One may say that it compresses the depression to a short time. In the same way it is possible that the different types of therapy against schizophrenia at least partly work by "compressing" the time of the illness.

Résumé.

Les déficiences pouvant survenir au cours d'une investigation concernant le pronostic de la schizophrénie sont discutées. Les données que comporte la littérature correspondante sont toutes plus ou moins incertaines. Une méthode correcte du calcul du pronostic est indiquée. En se servant de cette méthode, l'auteur trouve que 20 % des hommes et 16 % des femmes guérissent complètement dans l'espace de 10 ans et que 13 % des hommes et 12 % des femmes sont exempts au cours de périodes transitoires de tout au plus 3 ans. L'auteur expose les résultats du pronostic en tenant compte de l'âge et de l'aspect des différents symptômes accompagnant l'éruption de la maladie.

Zusammenfassung.

Die bei einer Untersuchung über die Prognose der Schizophrenie naheliegenden Fehlerquellen werden besprochen. In der einschlä-

gigen Literatur gemachte Angaben sind durchwegs mehr oder weniger zweifelhaft. Eine korrekte Methode für Prognoseberechnung wird mitgeteilt. Bei Anwendung dieser Methode findet der Verfasser, daß 20 % bei den Männern und 16 % bei den Frauen innerhalb von 10 Jahren wieder ganz gesund werden, daß außerdem 13 % bei den Männern und 12 % bei den Frauen während vorübergehenden Perioden (höchstens 3 Jahre) gesund sind. Außerdem werden Angaben über die Prognose gemacht unter Berücksichtigung des Alters und der verschiedenen Symptombilder bei der Erkrankung.

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THE ERUPTION OF THE PERMANENT TEETH IN THE NORMAL POPULATION OF SWEDEN

by GUNNAR DAHLBERG
and Arvid BERNHARD MAUNSBACH

A very large number of investigations as to the eruption of permanent teeth have been carried out. However, as a rule only mean values have been given and the materials have not been statistically analysed. In table 1, we give some figures from authors who also have given figures for the range of variation. It seems as if one has generally given this range by the aid of the extreme figures which have actually been found. It appears from the table that somewhat different figures have been obtained which however is natural, even if somewhat misleading as the range of variation increases with the number of cases.

The eruption of teeth should be associated with that rate in which the growth and general development occur. This rate is different in the various populations depending on dissimilarities in the populations regarding genetical as well as environmental factors.

Further, it must be remembered that the rate of growth in the same population can be subjected to changes. An investigation by *Broman, Dahlberg and Lichtenstein* has shown that about fifty years ago in Sweden the growth was considerably slower up to the age of 15 years, but after this age faster than is the case to-day. At that time the height of an individual 15 years of age was 15 cm less than now. When adult the corresponding difference was only 5 cm. The main reason for the increased height among adults ought to be a change of the gene composition which is conditioned by a gradual breaking up of the isolates (*Dahlberg* 1938), whereas the faster growth which occurs up to 15 years of age should be connected with environmental factors, and above all by improved nutrition. According to a theory advanced by *Dahlberg*, environmental factors often have an effect which accelerates or retards the rate of growth, but not in such a way that the final results are altered which, consequently, appear to be mainly genetically conditioned. Under such circumstances it is to be expected that also the age at which the permanent teeth erupt depends, to a certain degree, upon environmental factors; consequently one must expect to obtain different

Table 1.
Eruption of the permanent teeth in regard to age according to different authors.

| Author | Sex and number | Upper or lower jaw | Mean or range of variation | Number of tooth | | | | | | |
|--|---|--|--|---------------------------------|-----------------------------|--------------------------------|------------------------------------|------------------------------|-----------------------------|------------------------------|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Cartwright 1857 England | Boys and girls { 3074 | { Upper and lower jaw | Range of variation | 7-8 | 8-9 | 11-13 | 9-11 | 11-13 | 6-7 | 13-15 |
| Berten 1895 Würzburg | Boys and girls { Number: 3345 | { Upper jaw Lower jaw | Range of variation Range of variation | 5.5-8 5-7.5 | 6.5-9 6-8 | 8-10 7-9.5 | 8.5-12 9-13 | 10-14 9-12 | 10-13 10-14 | 11-14 10-13.5 |
| Dietlein 1895 Freiburg | Boys and girls | { Upper jaw Lower jaw | Mean Mean | 7.10 7.4 | 8.9 8.3 | 11.9 10.9 | 10.2 10.10 | 11.3 11.4 | 7.5 7.0 | 12.10 12.4 |
| Röse 1909 | Boys Number: 21139 | { Upper jaw Lower jaw | Mean Range of variation Mean Range of variation | 7.8 5.6-11.6 6.10 5-10 | 8.11 6-? 7.11 6-12 | 12.2 7.6-15 11.2 7-15 | 10.5 6.6-14.6 11.3 7-14.6 | 11.4 6.6-15 12 7-15 | 6.7 5-9.6 6.5 5-10 | 12.9 9-15 12.3 9-15 |
| Germany Sweden Denmark Holland Belgium Bohemia Switzerland | Girls Number: 19882 | { Upper jaw Lower jaw | Mean Range of variation Mean Range of variation | 7.5 5.6-11 6.7 5-11 | 8.6 6-? 7.7 6-12 | 11.7 7-15 10.3 7-14 | 10.1 6.6-14.6 10.8 7-14.6 | 11.1 7-15 11.7 7-15 | 6.6 5-10 6.3 5-9 | 12.5 9-15 11.9 8-15 |
| Cotte 1935 | Boys | { Upper jaw Lower jaw | Mean Mean | 6.8 6.7 | 7.5 7.2 | 8.7 7.8 | 11.3 10.5 | 10.4 10.7 | 10.6 10.8 | 12.7 12.4 |
| Germany (Harz) | Girls Boys and girls Number: 2054 | { Upper jaw Lower jaw Upper and lower jaw | Mean Mean Mean Range of variation | 6.7 6.6 5-8 | 7.1 6.9 5.5-9 | 8.0 7.6 7-10 | 10.9 10.0 9-15 | 9.9 10.5 9-13.5 | 10.3 10.5 9-14 | 12.3 12.1 11-15 |

[illegible]

Table 2.

| Age distribution of the cases. | | | |
|--|------|-------|------------|
| Age at the examination, completed years | Boys | Girls | Both sexes |
| 6.50- 6.99 | 147 | 143 | 290 |
| 7.00- 7.49 | 403 | 401 | 804 |
| 7.50- 7.99 | 433 | 433 | 866 |
| 8.00- 8.49 | 263 | 248 | 511 |
| 8.50- 8.99 | 226 | 209 | 435 |
| 9.00- 9.49 | 182 | 181 | 363 |
| 9.50- 9.99 | 161 | 150 | 311 |
| 10.00-10.49 | 148 | 153 | 301 |
| 10.50-10.99 | 142 | 147 | 289 |
| 11.00-11.49 | 173 | 118 | 291 |
| 11.50-11.99 | 165 | 173 | 338 |
| 12.00-12.49 | 141 | 126 | 267 |
| 12.50-12.99 | 136 | 135 | 271 |
| 13.00-13.49 | 120 | 105 | 225 |
| 13.50-13.99 | 96 | 93 | 189 |
| 14.00-14.49 | 74 | 89 | 163 |
| 14.50-14.99 | 57 | 59 | 116 |
| Total | 3067 | 2963 | 6030 |

values in the same population when examining the conditions at very different times, during which the standard of living has changed. One must also expect to find differences between the different social classes which fact has also been established by previous investigators. Differences between various populations are naturally to be expected, because these differ not only as regards environment but also as regards genetical conditions. It is therefore necessary that the data used for comparison in practical work is taken from the same population, and that they are not too old. This has partly been the reason for this investigation. We also intend to give a more complete picture of the processes by subjecting the material to some extent to a statistical analysis.

Material.

This investigation is based upon a material comprising 3067 boys and 2963 girls between 6½ and 15 years of age. The material is taken from the reports kept by the dental clinics at the district polyclinics. Since 1938 public dental clinics have begun to be established in Sweden. Dental treatment is given by these clinics at cheap price, and to school children often without cost. Practically all school

children have used this opportunity in the counties where clinics have been established. The reports have been collected from the following districts: Östergötland, Kronoberg, Malmöhus, Älvsborg and Örebro, 3115 children are from cities, and 2915 from small county towns and rural districts. It should, however, be of minor interest to divide the material according to demographic districts of different types, as the difference between these should not be so great. The reports are from 1940-45. The age distribution in the material appears

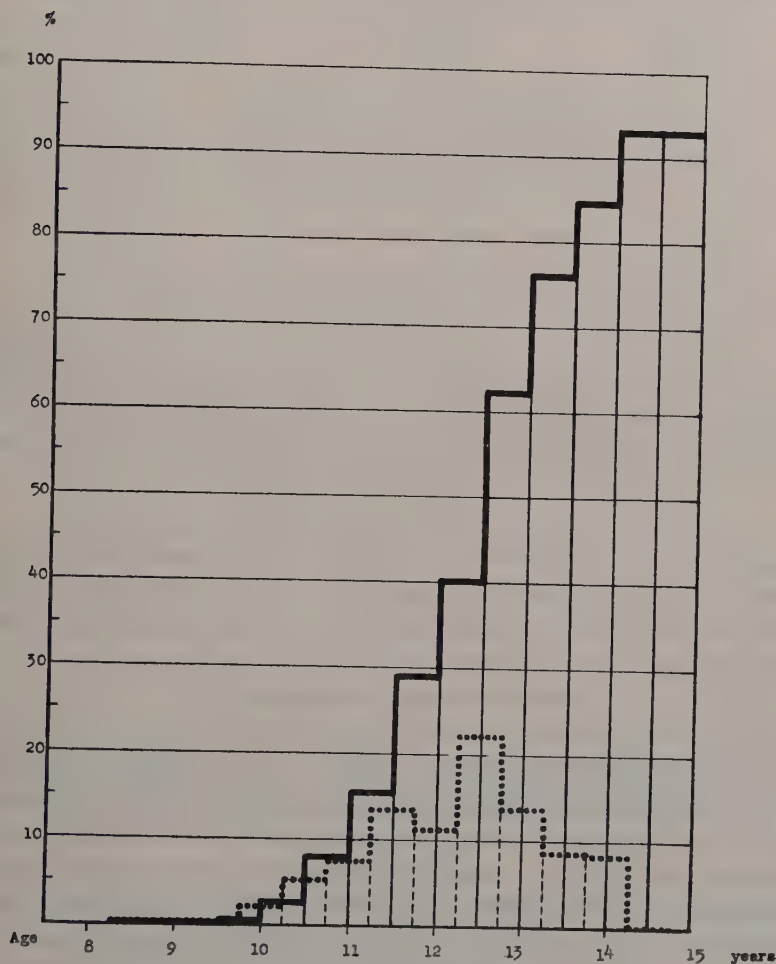


Fig. 1. Percentage number of boys with tooth No. 7 in the upper jaw erupted at different age (whole line) and the distribution of the probability of the tooth erupting at different age (broken line).

Table 3.

Age in boys and girls when the teeth break through (means of the right and left side).

| Tooth no. | Girls | | | | | Boys | | | | |
|------------|---------------------------------------|----------------|--------|----------------|---|---------------------------------------|----------------|--------|----------------|---|
| | Earliest age when the eruption begins | Lower quartile | Median | Upper quartile | Age when eruption has occurred in all cases | Earliest age when the eruption begins | Lower quartile | Median | Upper quartile | Age when eruption has occurred in all cases |
| Upper jaw: | | | | | | | | | | |
| 1 | — | — | 7.2 | 7.9 | 10.5 | — | — | 7.0 | 7.5 | 10.0 |
| 2 | — | 8.0 | 8.5 | 9.1 | — | — | 7.5 | 8.1 | 8.7 | 15.0 |
| 3 | 8.5 | 10.9 | 11.7 | 12.5 | — | 8.0 | 10.1 | 11.1 | 12.0 | — |
| 4 | 7.0 | 9.4 | 10.1 | 11.4 | — | — | 8.9 | 9.8 | 10.7 | 15.0 |
| 5 | 7.0 | 9.7 | 10.9 | 12.2 | 15.0 | 7.5 | 9.5 | 10.4 | 11.6 | 15.0 |
| 6 | — | — | — | 6.9 | 9.0 | — | — | — | 6.8 | 11.0 |
| 7 | 8.5 | 11.6 | 12.5 | 13.3 | — | 8.5 | 11.4 | 12.0 | 13.0 | — |
| Lower jaw: | | | | | | | | | | |
| 1 | — | — | — | — | 11.0 | — | — | — | — | 9.5 |
| 2 | — | — | 7.3 | 8.1 | 11.0 | — | — | 7.1 | 7.6 | 11.5 |
| 3 | 7.5 | 9.8 | 10.7 | 11.4 | 14.5 | 7.0 | 8.8 | 9.7 | 10.2 | 13.5 |
| 4 | 7.0 | 9.9 | 11.1 | 12.0 | — | 7.0 | 9.4 | 10.1 | 11.2 | 15.0 |
| 5 | 7.5 | 10.5 | 11.6 | 12.8 | — | 7.0 | 9.9 | 10.9 | 12.1 | — |
| 6 | — | — | — | — | 13.0 | — | — | — | — | 10.0 |
| 7 | 9.0 | 10.9 | 11.9 | 12.9 | — | 8.5 | 10.6 | 11.5 | 12.2 | — |

from table 2. It is regrettable that the younger children are not included in the material. The compulsory school age begins the year when children reach 7 years of age, thus causing a limitation of the material.

The eruption of the permanent teeth.

If one computes the relative number of children in whom a certain tooth has erupted, the frequency of the occurrence of the tooth at different ages yields an S-formed curve, an ogive. By successively subtracting adjoining classes from each other differences are obtained which form a probability curve. This expresses the relative probability of the eruption of the tooth at different ages, while the S-formed curve expresses the relative frequency of the tooth having appeared at different ages. In fig. 1 we have given an example of these two distributions, which graphically expresses the figures for the tooth no. 7 of the upper jaw in boys.

As regards the information found, it is most appropriate to give the median and quartiles for different teeth, as the material has not been observed for a sufficiently long time enabling one to obtain a complete distribution; the classes instead become open for the majority of teeth in the beginning or the end. Table 3 shows the median and quartile and also the highest and lowest figure found. These figures are graphically illustrated in fig. 2. It is obvious that the highest and lowest figure is accidentally conditioned to a high degree, and cannot be used as a measurement of the limits of the range of variation.

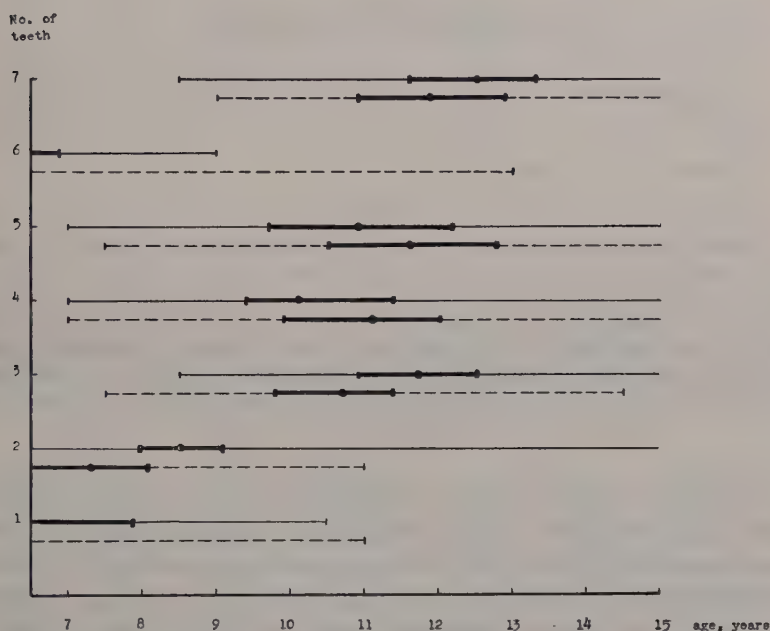


Fig. 2. Distribution according to age at the eruption of the permanent teeth in boys. The distance between the upper and the lower quartiles is indicated with a thick line (the point in the middle is the median) and the distance to the end of the range of variation with a thin line. (The broken thin line indicates the lower jaw).

If the erupted teeth distribute themselves according to a normal curve, the median and mean coincide, and, furthermore, the quartiles can be calculated from the standard deviation. It is, therefore, of special interest to see whether the distribution is normal, and this is why we have calculated the skewness by comparing the distances

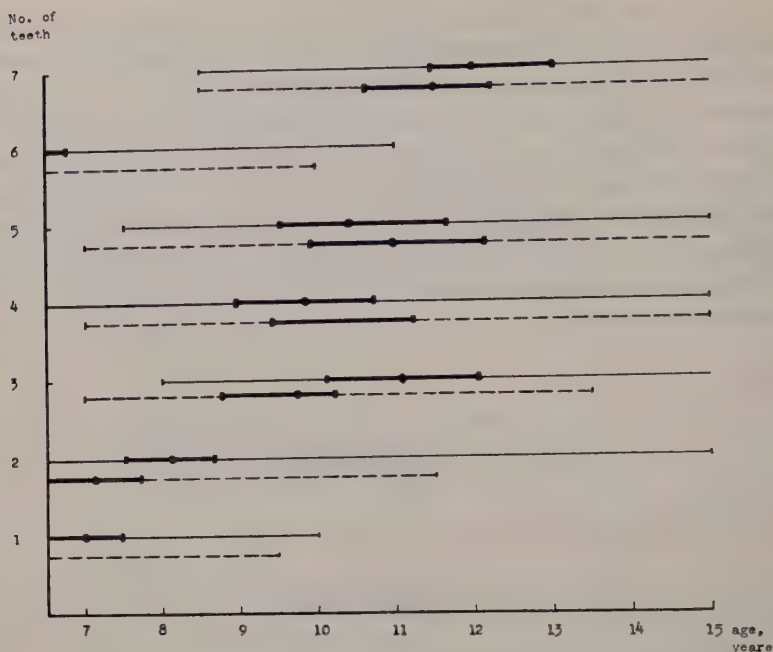


Fig. 3. Distribution according to age at the eruption of the permanent teeth in girls. The distance between the upper and the lower quartiles is indicated with a thick line (the point in the middle is the median) and the distance to the end of the range of variation with a thin line. (The broken thin line indicates the lower jaw).

of the first and third quartile from the median. If the distances are equal, the distribution can be considered as normal. In practice one must, naturally, reckon with differences arising at random, but these should not be too great, and should go in opposite directions partly cancelling each other for different teeth. No appreciable difference is found for the distance of the first and third quartiles from the median (see table 4).

It seems that no noteworthy skewness is found; this being the case the mean and the standard deviation have been given in table 5, and similarly the outer limits of the normal variation calculated from 3σ for the individual teeth. As the mean here can be assumed to be identical with the median, the standard deviation is calculated from the quartiles according to the formula:

$$\sigma = \frac{Q_3 - Q_1}{2 \times 0.6745}$$

Table 4.

Interval between the lower quartile and the median and the upper quartile and the median (in years).

| Tooth no. | Boys | | | | Girls | | | |
|-----------|--|--|--|--|--|--|--|--|
| | Upper jaw | | Lower jaw | | Upper jaw | | Lower jaw | |
| | Interval between lower quartile and median | Interval between upper quartile and median | Interval between lower quartile and median | Interval between upper quartile and median | Interval between lower quartile and median | Interval between upper quartile and median | Interval between lower quartile and median | Interval between upper quartile and median |
| 1 | — | 0.7 | — | — | — | 0.5 | — | — |
| 2 | 0.5 | 0.6 | — | 0.8 | 0.6 | 0.6 | — | 0.5 |
| 3 | 0.8 | 0.8 | 0.9 | 0.7 | 1.0 | 0.9 | 0.9 | 0.5 |
| 4 | 0.7 | 1.3 | 1.2 | 0.9 | 0.9 | 0.9 | 0.7 | 1.1 |
| 5 | 1.2 | 1.3 | 1.1 | 1.2 | 0.9 | 1.2 | 1.0 | 1.2 |
| 6 | — | — | — | — | — | — | — | — |
| 7 | 0.9 | 0.8 | 1.0 | 1.0 | 0.6 | 1.0 | 0.9 | 0.7 |

Table 5.

Mean and standard deviation and the range of variation calculated on the basis of 3 σ , in regard to the age of boys and girls at eruption of the individual teeth.

| Tooth no. | Boys | | | | Girls | | |
|------------|--|-------------------|----------------|----------------|-------------------|----------|---------------------------------|
| | Age at the eruption of the teeth, in years | | | | | | |
| | Mean | σ | M — 3 σ | M + 3 σ | Mean | σ | M — 3 σ — M + 3 σ |
| Upper jaw: | | | | | | | |
| 1 | 7.2 | 1.0 ¹⁾ | 4.2–10.2 | 7.0 | 0.7 ¹⁾ | 4.9– 9.1 | |
| 2 | 8.5 | 0.8 | 6.1–10.9 | 8.1 | 0.9 | 5.4–10.8 | |
| 3 | 11.7 | 1.2 | 8.1–15.3 | 11.1 | 1.4 | 6.9–15.3 | |
| 4 | 10.1 | 1.5 | 5.6–14.6 | 9.8 | 1.3 | 5.9–13.7 | |
| 5 | 10.9 | 1.9 | 5.2–16.6 | 10.4 | 1.6 | 5.6–15.2 | |
| 6 | — | — | — | — | — | — | |
| 7 | 12.5 | 1.3 | 8.6–16.4 | 12.0 | 1.2 | 8.4–15.6 | |
| Lower jaw: | | | | | | | |
| 1 | — | — | — | — | — | — | |
| 2 | 7.3 | 1.2 ¹⁾ | 3.7–10.9 | 7.1 | 0.7 ¹⁾ | 5.0– 9.2 | |
| 3 | 10.7 | 1.2 | 7.1–14.3 | 9.7 | 1.0 | 6.7–12.7 | |
| 4 | 11.1 | 1.6 | 6.3–15.9 | 10.1 | 1.3 | 6.2–14.0 | |
| 5 | 11.6 | 1.7 | 6.5–16.7 | 10.9 | 1.6 | 6.1–15.7 | |
| 6 | — | — | — | — | — | — | |
| 7 | 11.9 | 1.5 | 7.4–16.4 | 11.5 | 1.2 | 7.9–15.1 | |

¹⁾ In these cases σ has been computed according to the formula $= \frac{Q_3 - M}{0.6745}$, as it was not possible to get Q_1 on the basis of the material (cf. table 3).

where Q_3 and Q_1 are the upper and the lower quartiles respectively. One now reckons with that in normal distribution only 0.15 % are above the limit of 3σ from the mean and equally as many below the limit $M - 3 \sigma$.

Two questions remain to be discussed, namely, the occurrence of sex differences, and differences between the upper and lower jaw.

If we first compare boys and girls, we will find that the permanent teeth on the whole erupt first in girls (see table 6). The differences

Table 6.

Age difference between the sexes in regard to eruption of the teeth.

| No. of the tooth | Difference between boys and girls | | |
|---------------------|-----------------------------------|--------|-------------------|
| | Lower quartile | Median | Upper quartile |

Upper jaw:

| | | | |
|---|-----|-----|-----|
| 1 | — | 0.2 | 0.4 |
| 2 | 0.5 | 0.4 | 0.4 |
| 3 | 0.8 | 0.6 | 0.5 |
| 4 | 0.5 | 0.3 | 0.7 |
| 5 | 0.2 | 0.5 | 0.6 |
| 6 | — | — | 0.1 |
| 7 | 0.2 | 0.5 | 0.3 |

Lower jaw:

| | | | |
|---|-----|-----|-----|
| 1 | — | — | — |
| 2 | — | 0.2 | 0.5 |
| 3 | 1.0 | 1.0 | 1.2 |
| 4 | 0.5 | 1.0 | 0.8 |
| 5 | 0.6 | 0.7 | 0.7 |
| 6 | — | — | — |
| 7 | 0.3 | 0.4 | 0.7 |

amount on an average to a little less than 6 months in the upper jaw and a little more than 6 months for the teeth in the lower jaw. It must be stressed particularly that approximately the same difference is found, as appears in the table, vis-à-vis the quartiles and medians which naturally is to be expected when the material concerned is so large. *Röse's* values show similar differences though not as great.

Table 7.

Age differences with regard to the eruption of the teeth in the upper jaw and in the lower jaw.

| No. of the tooth | Diff. between upper jaw and lower jaw | | |
|---------------------|---------------------------------------|--------|-------------------|
| | Lower quartile | Median | Upper quartile |
| Boys: | | | |
| 1 | — | — | — |
| 2 | — | +1.2 | +1.0 |
| 3 | +1.1 | +1.0 | +1.1 |
| 4 | +0.5 | —1.0 | —0.6 |
| 5 | —0.8 | —0.7 | —0.6 |
| 6 | — | — | — |
| 7 | +0.7 | +0.6 | +0.4 |
| Girls: | | | |
| 1 | — | — | — |
| 2 | — | +1.0 | +1.1 |
| 3 | +1.3 | +1.4 | +1.8 |
| 4 | —0.5 | —0.3 | —0.5 |
| 5 | —0.4 | —0.5 | —0.5 |
| 6 | — | — | — |
| 7 | +0.8 | +0.5 | +0.8 |

We will now compare the figures for the lower and upper jaw (see table 7). The figures show approximately the same displacements for the boys as for the girls i. e. the 2nd, 3rd and 7th tooth come first in the upper jaw, and the 4th and 5th in the lower jaw. If one disregards the sign, the differences amount to approximately 9 months. Also here *Röse* finds approximately the same differences as we do, though less pronounced.

The time for eruption of the permanent teeth is in itself of no greater interest. It is not until they are regarded in connection with other facts that they become of importance.

The figures for the eruption of the permanent teeth can, in the first place, be employed when judging the degree of development in children at a certain age, in the same way as one utilises the ossific centres. For this purpose, the most simple method is to tabulate the number of teeth a child has at different ages. It is well-known that differences in the rate of growth are found between various races.

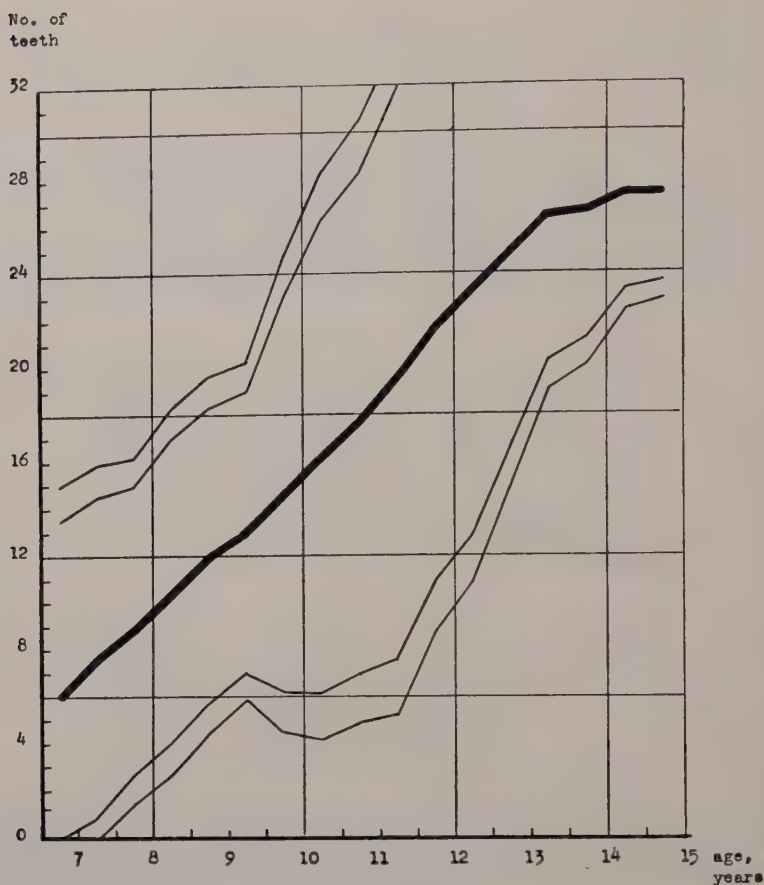


Fig. 4. Number of permanent teeth (present and missing) in boys of different ages. Thick line = means. The thin lines indicate the range of variation up to $2\frac{1}{2}\sigma$ and 3σ respectively on each side of the means.

This is most easily established by measuring stature and by deciding the time for the occurrence of menstruation. It is, however, to be supposed that differences exist also in regard to the average occurrence of senility. This could be investigated by deciding the average age when presbyopia occurs.

From a racial point of view it may also be possible to establish differences vis-à-vis the eruption of permanent teeth. However, no such investigations have been made. In order to be able to make such comparisons one must of course know the number of teeth which have erupted at different ages.

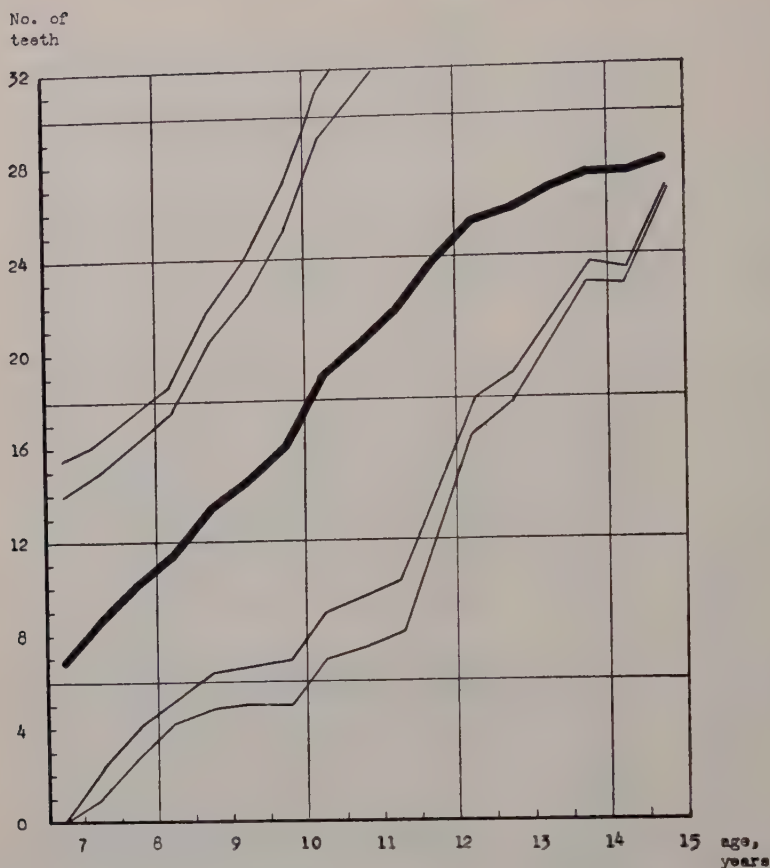


Fig. 5. Number of permanent teeth (present and missing) in girls of different ages. Thick line = means. The thin lines indicate the range of variation up to $2\frac{1}{2}\sigma$ and 3σ respectively on each side of the means.

In table 8 we give such figures for boys and girls. The number of teeth having appeared is, however, also dependent on the number of extracted permanent teeth; this number, of course, depends on to what extent dental treatment has been given, and in which environment the individual concerned is living etc. Therefore, specifications as to the number of existing + extracted teeth are given in the table. Further, figures for the mean, the standard deviation and the range of variation calculated according to $M \pm 2\frac{1}{2}\sigma$ and $M \pm 3\sigma$ are given. These figures are illustrated graphically in figs 4 and 5. It must be emphasised, that for the older age-groups the distribution is skew

because it is limited upwards by 32 teeth, as one cannot of course have more teeth than that number.

It should be possible to employ these tables when deciding whether the growth of teeth is retarded in a child, and they should, in the first place be of importance when endocrine disturbances are concerned. These tables complete, in other words, the normal tables of the development of ossific centres at different ages which were published by Dr. O. *Elgenmark*, and worked out at this institute.

Summary.

The eruption of the permanent teeth is analysed from a statistical point of view on 3 067 boys and 2 963 girls between 6½ and 15 years of age. As a result a table of the mean number and the standard deviation of erupted permanent teeth at different ages in boys and girls is given. The table could be used when deciding whether the growth of teeth is retarded or not in a child.

Résumé.

La statistique de la seconde dentition de 3067 garçons et de 2963 jeunes filles âgés de 6½ à 15 ans est analysée. Les résultats sont exposés dans un tableau comportant le nombre moyen et la dispersion de dents permanentes apparues chez des garçons et des jeunes filles d'âge différent. Le tableau sert à déterminer si le développement d'un enfant est retardé.

Zusammenfassung.

Der Zahnwechsel wird an 3067 Knaben und 2963 Mädchen im Alter von 6½ bis 15 Jahren statistisch analysiert. Die durchschnittliche Anzahl und die Streuung von erschienenen permanenten Zähnen bei Knaben und Mädchen verschiedenen Alters wird tabellarisch wiedergegeben. Die Tabelle kann angewandt werden, wenn zu entscheiden ist, ob die Entwicklung eines Kindes verzögert ist.

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THE ANGLE OF THE EXTERNAL EAR TO THE MEDIAN PLANE OF THE SKULL IN CHILDREN

by LARS LINDER ¹⁾

The aim of the present investigation is to obtain information about the angle of the external ear to the median plane of the skull in part of the Swedish population. This is to constitute a background for a genetical investigation of the character which will, later on, be carried out at the State Institute of Human Genetics. The character in itself is of course of little interest, but in order to establish paternity and similar questions it would be of importance to know to which extent this angle is conditioned by hereditary factors.

In the literature the morphological structure and anthropology of the external ear is treated comparatively exhaustively and in detail. The question as to the position of the external ear in relation to the head has not, however, attracted great interest, and as far as we could find the angle has only been given slight attention. In the work of authors such as *Fürst* (1893), *Quelprud* (1932 a) and *Schwalbe* (1891), one only finds casual comments to the effect that the angle of the ear to the head can vary considerably in different persons. From a hereditary viewpoint, *Leicher* (1928) gives information about three families with extremely protruding ears, but he does not give any measurements of the angle.

In another work, *Quelprud* (1932b) gives a classification of the angle of the ear. He characterizes the ears as either $\frac{1}{1}$, $\frac{2}{3}$, $\frac{1}{2}$ and $\frac{1}{3}$ protruding or close. He also measures the angle between the tip of the ear and the head, and gives the differences between these angles for the right and the left side in a twin-material. In identical twins he finds that the average difference is 4.1 degrees, and in fraternal 5.0 degrees. He does not, however, say whether the angle is greatest on the left or right side.

¹⁾ The present investigation was proposed to me by Professor *Dahlberg*; I wish warmly to thank him for this, as well as for advice and help he has given me.

Especially since Lombroso advanced his doctrine about signs of degeneracy in criminals and insane persons, protruding ears have attracted a certain amount of interest. These ears have been regarded as malformations, and one has tried to establish the frequency of the malformations. *Gradenigo* (1891) gives in a survey of the literature some figures. However, since it is not quite clear what is meant by protruding ears, older data have little interest. *Gradenigo* himself considers ears which are at a right angle to the surface of processus mastoideus as protruding. This plane, however, also forms an angle to the median plane of the head, which is why the angle measured by *Gradenigo* becomes very large. For normal men he finds 11.1 % with protruding ears, and for women 3.1 %. There seems to be a difference between the sexes in as much as such protruding ears are found more frequently in men than in women. Furthermore, he finds considerably higher values for insane persons and criminals whom he terms as degenerated. It is hardly possible that such a difference exists. Such dissimilarities could arise from the fact that inexact methods of measuring were employed, and also be due to the conclusions being drawn from a small material.

Karutz (1897) treats the protrusion of ears from a racial point of view. He asserts that the conception maintained by many authors that protruding ears characterize certain races, such as the Mongolian race, is incorrect. He thinks that these kinds of differences if they exist must originate from external factors e. g. the various ways different races cover their heads. *Geipel* (1933) gives a description of an instrument for measuring the angle of the ear, which in principle is the same as the one used in this investigation.

Thus, as no systematic examination has been made as regards the angle of the external ear to the head in an average population, an examination of this problem should be of interest.

Account of the cases.

Measurements have been made on cases consisting of all pupils aged 8-16 years attending one of the elementary schools and Praktiska Mellanskolan in Uppsala. The material could therefore be considered as representative, and comprises 255 boys and 336 girls. 15 individuals who had operation-scars behind the ear were eliminated. That girls are in majority, 56.85 per cent, is because the Praktiska Mellanskolan has more classes for girls than for boys. The distribution of the cases according to age appears in table 1.

Table 1.

Age distribution of the cases.

| Age, Years | Boys | Girls | Total |
|------------|------|-------|-------|
| 8 | 30 | 38 | 68 |
| 9 | 19 | 39 | 58 |
| 10 | 36 | 29 | 65 |
| 11 | 29 | 28 | 57 |
| 12 | 39 | 25 | 64 |
| 13 | 28 | 61 | 89 |
| 14 | 40 | 67 | 107 |
| 15 | 26 | 41 | 67 |
| 16 | 8 | 8 | 16 |
| Total | 255 | 336 | 591 |

Method and error of measurement.

In order to obtain the sought for angle, a simple instrument has been employed. This consists of a protractor with a graduated arch, from the center an adjustable pointer emanates indicating the degree on the scale.

The investigator has adjusted the ruler parallel to the sagittal plane through the head of the individual to be measured. It was ensured that the pivot of the pointer was placed vertically over the point of attachment of the ear. Then the pointer was adjusted so that it was situated along with the outer border line of the ear. The angle was then read.

In order to procure a conception as to the reliability of the method of measurement employed, the error of method has been determined by means of double measurements on 180 children. The error of measurement was determined according to the formula:

$$\sigma_m = \sqrt{\frac{\sum d^2}{2n}} ;$$

σ_m = the error of measurement, d = the differences between the double measurements, and n = the number of double determinations (Dahlberg 1926). The error of method was found to be 2.26 which is 10.8 per cent of the mean, and 21.6 per cent of the variation-breadths. The error is comparatively large which might depend especially on the fact that some ears are more or less bent.

Before presenting the results we will discuss to what extent differences in age might influence the angle of the ear. In order to be able to use the angle of the ear in this way for a comparison from a hereditary viewpoint between two different generations, for example between father and son, one must know that the angle is constant, i. e. is not changed with age. No investigations seem to have been carried out concerning this. All that is known is that the skull completes its development comparatively early. It is therefore possible that the angle of the ear also becomes constant relatively early, but this fact must of course be empirically verified.

It is first and foremost of interest to take a look at the distribution in the material which is given in table 2. The distribution is further illustrated in fig. 1, which shows the frequency of the different degrees of the angle of the right ear in boys and girls. The mean values are given below.

Table 2.

Distribution on different degrees. The cases are divided in classes of 5 degrees.

| Degrees | Boys | | Girls | | Total |
|---------|-------|------|-------|------|-------|
| | Right | Left | Right | Left | |
| 5 | 1 | 7 | 23 | 33 | 64 |
| 10 | 8 | 10 | 59 | 58 | 135 |
| 15 | 25 | 25 | 77 | 84 | 211 |
| 20 | 50 | 58 | 63 | 65 | 236 |
| 25 | 42 | 36 | 54 | 39 | 171 |
| 30 | 49 | 49 | 30 | 31 | 159 |
| 35 | 36 | 29 | 8 | 36 | 79 |
| 40 | 22 | 18 | 11 | 9 | 60 |
| 45 | 7 | 10 | 2 | 4 | 23 |
| 50 | 8 | 8 | 3 | 2 | 21 |
| 55 | 2 | 2 | 4 | 4 | 12 |
| 60 | 3 | 2 | — | — | 5 |
| 65 | — | — | 2 | 1 | 3 |
| 70 | — | — | — | — | — |
| 75 | — | — | — | — | — |
| 80 | 1 | 1 | — | — | 2 |
| 85 | — | — | — | — | — |
| 90 | 1 | — | — | — | 1 |

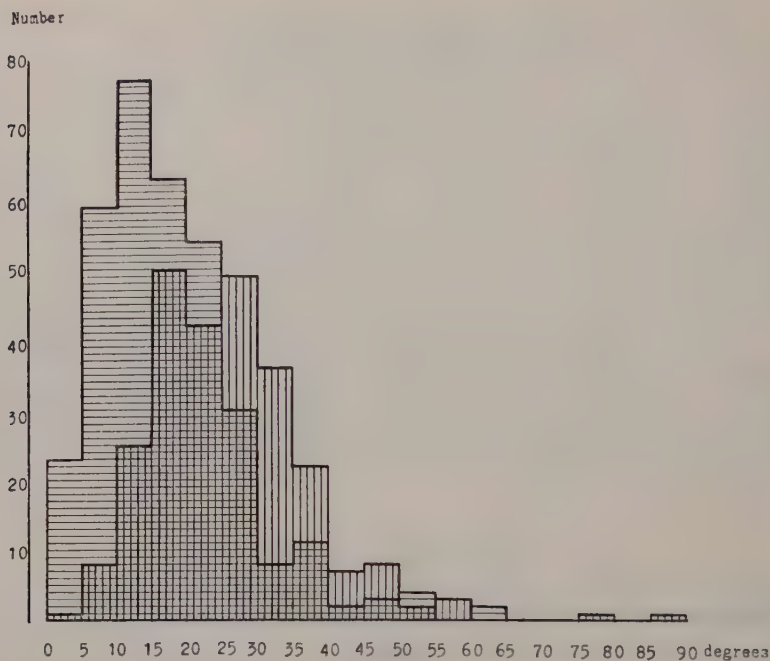


Fig. 1. Distribution of the angle of the right ear. Horizontally lined area = girls (336), vertically lined area = boys (255).

| | Left angle | Right angle |
|-------|--|--|
| Boys | $M \pm \varepsilon (M) = 25.20 \pm 0.69^\circ$ | $M \pm \varepsilon (M) = 26.41 \pm 0.65^\circ$ |
| Girls | $M \pm \varepsilon (M) = 17.03 \pm 0.54^\circ$ | $M \pm \varepsilon (M) = 18.13 \pm 0.59^\circ$ |

As indicated by the figures there exists a difference firstly between the sexes, and secondly a small difference between the mean values for the right and left side in both boys and girls, the angle on the right side being somewhat greater.

In order to obtain a conception as to whether there are any noteworthy differences between the different age groups, the mean values of these groups are given in table 3.

The number of cases in the different age groups is small, consequently the standard errors of the means are large. As far as can be estimated from the figures no systematic displacement according to age exists. The difference between the age groups, 8 years and 14 years, is for the right ear = $3.67 \pm 3.06^\circ$ in boys, and = $1.73 \pm 2.47^\circ$ in girls. As can be seen from the standard errors, it is evident that the differences may be due to random variation.

Table 3.

Mean angle of the ears and its standard error in different age groups.

| Age, Years | Number | Right $M \pm \varepsilon (M)$ | Left $M \pm \varepsilon (M)$ |
|------------|--------|----------------------------------|---------------------------------|
| Boys | | | |
| 8 | 30 | 30.87 ± 2.76 | 31.20 ± 2.91 |
| 9 | 19 | 26.11 ± 1.45 | 25.95 ± 1.59 |
| 10 | 36 | 23.75 ± 1.69 | 23.97 ± 1.61 |
| 11 | 29 | 24.00 ± 1.50 | 21.79 ± 1.99 |
| 12 | 39 | 28.54 ± 2.27 | 24.15 ± 1.72 |
| 13 | 28 | 27.46 ± 1.48 | 26.04 ± 1.60 |
| 14 | 40 | 27.30 ± 1.32 | 25.45 ± 1.43 |
| 15 | 26 | 23.96 ± 1.96 | 24.00 ± 1.70 |
| 16 | 8 | 29.50 ± 5.45 | 28.13 ± 5.77 |
| Girls | | | |
| 8 | 38 | 20.18 ± 2.15 | 19.21 ± 1.90 |
| 9 | 39 | 17.85 ± 2.03 | 15.87 ± 1.91 |
| 10 | 29 | 16.17 ± 1.26 | 14.90 ± 1.17 |
| 11 | 28 | 22.82 ± 1.92 | 22.96 ± 2.18 |
| 12 | 25 | 17.64 ± 1.76 | 16.88 ± 1.72 |
| 13 | 61 | 16.69 ± 2.39 | 15.43 ± 1.12 |
| 14 | 67 | 18.45 ± 1.22 | 16.43 ± 1.09 |
| 15 | 41 | 17.68 ± 1.38 | 18.22 ± 1.57 |
| 16 | 8 | 13.13 ± 2.12 | 14.63 ± 2.61 |

When examining the material according to the X^2 -method no displacements are found apart from those displacements from the means which are to be expected at random ($P = 0.98$ for boys and 0.93 for girls). This indicates that the angle is constant, at any rate after the beginning of school age, but it is naturally desirable to procure a confirmation of this on a larger number of cases. Any great displacement could undoubtedly not take place, because it then would have become evident already in this material.

We now return to table 2. We have already pointed out that there is a difference between the sexes, namely that the boys show a greater angle than the girls. The difference is significant from a statistical point of view. Thus, for the right ear it is $8.28 \pm 0.88^\circ$, and for the left $8.17 \pm 0.88^\circ$.

Now it can be queried: on which factors could such a marked difference depend? Firstly it can be discussed whether the differences can depend on environmental factors, for example, that the girls' ears are more exposed to pressure during the period of growth. This does not occur, at any rate in a civilised country. Furthermore, it could, perhaps, be conceivable that the slight pressure caused by the girls' hair which generally falls over the ears might explain why their ears do not protrude to the same degree as the boys' who have usually cropped hair. As the structure of the ear is very elastic it is, however, hardly possible that such a slight pressure should effect the position of the ear. Another possibility is that the difference might depend upon the different rate of development in the sexes. Since we have not found any age difference, this possibility need not be discussed. It can then be assumed that it is a question about a hereditary average difference between the sexes; the difference being similar to the difference between the sizes of the ears which has been established previously.

Apart from this difference between the sexes, a dissimilarity seems to be found, between the left and right angle of the ear both in boys and girls. This difference, however, has a large standard error. In order to obtain smaller standard errors, the differences between the left and right ear in the individuals have been calculated. The difference found in this way is for boys $1.21 \pm 0.35^\circ$ which is statistically significant, and for girls $1.07 \pm 0.44^\circ$ which difference is almost probable from a statistical point of view. This shows that in both sexes the right ear, on an average, forms a somewhat greater angle to the median plane of the skull than the left ear. If a factor which only affects the one side could be found it might be conditioned by environment e. g. if children in general slept more often on the left ear than on the right (which habit could, in this turn, be connected with right handedness). We know nothing about such facts, and it is, therefore, impossible a priori to decide whether this character is conditioned by heredity or not. We must here confine ourselves to establish the fact, but we are going to discuss the question later on.

The distribution of the differences between the left and the right ear appears in table 4 a showing the frequency of individuals with the differences varying between 1 and 47 degrees. The negative sign denotes that the angle of the left ear is the greatest, and the positive that the right angle is the greatest.

Table 4a.

Distribution of the differences between right and left ear in the whole material. Negative sign indicates that the left angle is the larger one, positive sign that the right angle is the larger one.

| Diff. in degrees (pos.) | Freq. | Diff. in degrees (pos.) | Freq. | Diff. in degrees (neg.) | Freq. | Diff. in degrees (pos.) | Freq. |
|-------------------------------|-------|-------------------------------|-------|-------------------------------|-------|-------------------------------|-------|
| +1 ¹⁾ | 6 | +19 | 1 | — 1 ¹⁾ | 7 | — 19 | — |
| +2 | 10 | +20 | 1 | — 2 | 13 | — 20 | — |
| +3 | 9 | +21 | 1 | — 3 | 8 | — 21 | — |
| +4 | 11 | +22 | 2 | — 4 | 4 | — 22 | — |
| +5 | 13 | +23 | — | — 5 | 10 | — 23 | — |
| +6 | 15 | +24 | — | — 6 | 4 | — 24 | — |
| +7 | 11 | +25 | — | — 7 | 5 | — 25 | — |
| +8 | 14 | +26 | 2 | — 8 | 3 | — 26 | 1 |
| +9 | 4 | +27 | — | — 9 | 4 | — 27 | — |
| +10 | 7 | +28 | — | — 10 | 9 | — 28 | 1 |
| +11 | 8 | +29 | 1 | — 11 | 2 | — 29 | — |
| +12 | 9 | +30 | — | — 12 | 2 | — 30 | — |
| +13 | 5 | +31 | — | — 13 | 1 | — 31 | 1 |
| +14 | 3 | +38 | — | — 14 | 1 | — 38 | 1 |
| +15 | 5 | +40 | — | — 15 | 3 | — 40 | — |
| +16 | — | +42 | 1 | — 16 | 1 | — 42 | — |
| +17 | 2 | +44 | 1 | — 17 | — | — 44 | — |
| +18 | 5 | +47 | 1 | — 18 | 2 | — 47 | — |

Table 4b shows the same distribution for boys and girls separately.

Table 4b.

Distribution of the differences between the right and the left ear in boys and girls.

| Diff. in degrees (pos.) | Boys | Girls | Diff. in degrees (neg.) | Boys | Girls |
|-------------------------------|------|-------|-------------------------------|------|-------|
| +1 ²⁾ | 3 | 3 | — 1 ²⁾ | 1 | 6 |
| +2 | 4 | 6 | — 2 | 1 | 12 |
| +3 | 5 | 4 | — 3 | 3 | 5 |

¹⁾ 362 cases with no difference between the angles.

²⁾ 170 boys and 192 girls with no difference between the angles

| Diff. in degrees (pos.) | Boys | Girls | Diff. in degrees (neg.) | Boys | Girls |
|-------------------------------|------|-------|-------------------------------|------|-------|
| +4 | 3 | 8 | — 4 | 2 | 2 |
| +5 | 6 | 7 | — 5 | 2 | 8 |
| +6 | 6 | 9 | — 6 | 3 | 1 |
| +7 | 3 | 8 | — 7 | 3 | 2 |
| +8 | 3 | 11 | — 8 | — | 3 |
| +9 | 2 | 2 | — 9 | 2 | 2 |
| +10 | 4 | 3 | — 10 | 5 | 4 |
| +11 | 3 | 5 | — 11 | — | 2 |
| +12 | 3 | 4 | — 12 | 1 | 1 |
| +13 | 2 | 3 | — 13 | — | 1 |
| +14 | 3 | — | — 14 | 1 | — |
| +15 | 3 | 2 | — 15 | — | 3 |
| +16 | — | — | — 16 | — | 1 |
| +17 | — | 2 | — 17 | — | — |
| +18 | 3 | 2 | — 18 | 1 | 1 |
| +19 | 1 | — | — 19 | — | — |
| +20 | — | 1 | — 20 | — | — |
| +21 | 1 | — | — 21 | — | — |
| +22 | 1 | 1 | — 22 | — | — |
| +26 | — | 1 | — 26 | — | 1 |
| +29 | — | 1 | — 28 | 1 | — |
| +42 | — | 1 | — 31 | — | 1 |
| +44 | — | 1 | — 38 | — | 1 |
| +47 | — | 1 | — 47 | — | — |

Eventually the distribution of the differences are illustrated graphically in fig. 2.

In this distribution of the differences the excess (E) has been calculated according to the formula:

$$E = \frac{\sum nd^4}{N\sigma} - 3,$$

where d is the deviations of the class means from the average and n is the number of individuals in the separate classes and N the total number of individuals.

The 0-group is, as can be seen, predominating and comprises 362 out of 591 individuals. Evidently the most frequent is that the

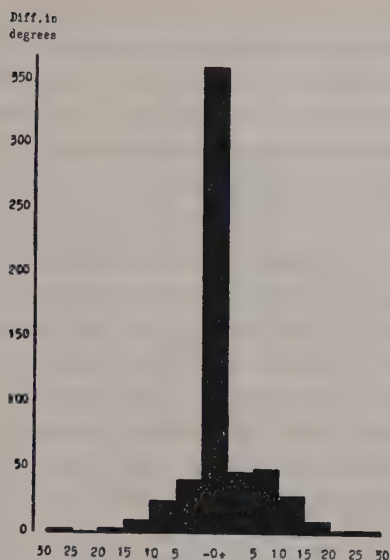


Fig. 2. Distribution of differences between right and left ear. + indicates that the angle of the right side is the larger one; - indicates that the angle of the left side is the larger one.

angles of both the right and left ear are equal, but the diagram and the excess show also that when the angles differ, the differences can be quite large. It may be a quite common biological phenomena that two things who are connected with each other as a rule are inclined to correspond, but if they differ, then the difference is comparatively great. This is true of the radius and ulna and of the jaws which has been shown by *Hultén* (1928), and by *Björk* (1947) respectively.

Now, it is of special interest to observe to which extent the large deviations occur on the right and the left side. It is found that differences of more than 10, 15 and 20 degrees are more than twice as frequent when the angle of the right side is the greatest than when the left one is greatest. This appears from the following figures:

| Difference of more than | 10° | 15° | 20° |
|--|----------------|---------------|---------------|
| Right angle greatest: | 23.38 per cent | 9.96 per cent | 4.35 per cent |
| Left angle greatest: | 10.82 per cent | 4.33 per cent | 1.73 per cent |
| Ratio between frequency of right side and frequency of left side | 2.2 | 2.3 | 2.5 |

It is evident that this occurs more frequently for the right ear, i. e. the right ear forms a greater angle than the left. Under such conditions, it is probable that the previously proved average difference between the left and the right ear is associated with genetical factors, and not with the environmental factors previously discussed. The large deviations concerned here are not likely to depend on environmental factors of such nature that they evade attention.

The differences between the right and the left side are not, however, related to each other in the same way in both sexes. When the differences have higher values, then the frequency for the girls is somewhat greater than for the boys. This is illustrated in the following table where the frequency is given in per cent for the boys and girls, respectively, with differences of more than 10, 15, 20, 25 and 30 degrees between the right and left side.

| | More than 10° | 15° | 20° | 25° | 30° |
|-------|-------------------|---------|---------|---------|---------|
| Boys | 13.2±2.1 per cent | 4.3±1.3 | 1.2±0.7 | 0.4±0.4 | 0.0±0.0 |
| Girls | 13.4±1.9 per cent | 6.6±1.4 | 3.3±1.0 | 2.7±0.9 | 1.5±0.7 |

This difference between boys and girls is, however, not statistically significant.

In order to give an idea of how great a per cent of the material can be considered as having equal angles on the right and left side, respectively, with due consideration to the source of error which lies in the error of measurement, the differences of 5 degrees and below are regarded as equal. It is then found that 62 boys out of 255, or 24.1 per cent, and in girls 80 girls out of 336, or 23.8 per cent, i. e. a total of 142 out of 591 children, or 24 per cent, have a difference of more than 5 degrees between the left and right angle of the ear. With this limit approximately $\frac{1}{4}$ of the cases have an unequal protrusion of their ears.

If the limit is set to 7 degrees (about 3 times the error of measurement) one obtains 20.7 per cent, or about $\frac{1}{5}$, of the cases. The average angle for individuals with equal angles of the ear on both sides then becomes $M = 25.39^\circ$ for boys, and $M = 16.54^\circ$ for girls.

Summary.

In the present paper figures are given for the angle of the ear in the normal population. It appears that there exists an average difference between the sexes, and also between the right and left

ear. The latter difference especially has been analysed, whereby it was proved that in rare cases this difference can reach comparatively high figures.

Résumé.

L'angle formé par l'oreille humaine normale est exprimé numériquement. Il est démontré qu'il existe une différence moyenne entre les sexes et l'oreille droite et gauche. Le second cas a été spécialement analysé et il a pu être prouvé que cette différence, dans des cas exceptionnels, peut être relativement grande.

Zusammenfassung.

In der vorliegenden Arbeit wird der Winkel, den das normale menschliche Ohr bildet, zahlenmäßig ausgedrückt. Es wird gezeigt, daß ein durchschnittlicher Unterschied zwischen den Geschlechtern und ebenso zwischen dem rechten und linken Ohr besteht. Letzterer Unterschied ist eingehend analysiert worden, wobei bewiesen werden konnte, daß in Ausnahmefällen dieser Unterschied verhältnismäßig groß sein kann.

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ENVIRONMENT, INHERITANCE AND RANDOM VARIATIONS WITH SPECIAL REFERENCE TO INVESTIGATIONS ON TWINS

by GUNNAR DAHLBERG

Introduction: Genes and Characteristics.

In Physical Chemistry man has gone quite a long way towards relating the characteristics of a substance to its structure. For example, it is possible, knowing the structure of a substance, to calculate its acidity and solubility in water. Man's brain processes however, present a problem hitherto quite unsolved. We are still unable to relate psychical phenomena to the chemical-physical processes that take place in the brain at the same time. We do know in some simple cases that a certain injury to the brain will produce certain psychical disturbances, but we are still a long way from a real understanding of the connection between the psychic and physical chemistry.

The problem of the relationship between characteristics and the structure of the corresponding genes is also practically unsolved. Several authors, among whom *Bleuler* (1925) should be especially mentioned, have tried to solve problems of heredity from a psychical point of view. *Bleuler* supposes the function of memory to be common to all cells including the reproductive ones. According to him, what takes place in our brains when we remember is similar to what takes place when the fertilised egg develops into a new individual. In genetics, greater success has been achieved by approaching the problem from the chemical-physical point of view. In spite of this, we know little about the structure of the genes and, therefore, have not progressed far towards relating their effect to their structure.

Inheritance, Environment and Random Variation.

In the first attempts to explain the characteristics of an individual, a distinction was made between "Nature and Nurture", to use *Galton's* terminology, i. e. it was supposed that a characteristic

was determined partly by environment, partly by inheritance, and partly by both. Even though it was clear that the pre-natal environment could be of importance, consideration was mainly given to the postnatal environment, and it was hardly imagined that the environment within the cells containing the genes played any part at all.

In later years it was found that certain virus may already have an appreciable effect in the pre-natal stage. This is especially true of the rubeola virus. In certain cases, vitamin deficiencies and disturbances in the supply of hormones also seem able to produce surprising effects. As a result of this information our conception of the cause of malformations seems to be in need of some revision. An excellent survey of our knowledge of malformations was given by *Dunn* (1939). I have fortunately had the advantage of discussing the problems treated in this paper with my friend Professor *Leslie C. Dunn*, for which I warmly thank him. Of course being a professor too he does not quite agree with my views.

Later some genetical research was also done in connection with inquiry into the process of development, especially after *Speeman's* discovery of organisers. It has been proved that in spite of the symmetrical distribution of the chromosomes and genes, cell division is asymmetrical in that centres appear at certain points in the otherwise homogeneous substance of cells and stimulate development in a certain direction. The organisers formed in these centres are of a chemical nature. It has been possible to prove this since they can be substituted by extractions from these centres.

They have a stimulating effect similar to that which the sperm has on the egg. Just as other chemical substances and certain irritations of other kinds can be a substitute for the sperm, so it is possible that eventually substitutes may be found for the organisers. The interesting thing about this, however, is that the organisers only appear at certain points. Of course, chemical differences between the centre and the other parts must appear. Therefore the cell will gradually become asymmetrical in chemical-physical respects. On the other hand, development is symmetrical in that the cells outside the centre all have an equal possibility of development and the course of development is dependent on which organiser provides the stimulus.

Anyways the situation is such that small changes in the cytoplasm sometimes seem to play a determining part in the appearance

of certain characteristics. Such changes are probably governed by random variation in the cytoplasm of the different cells and are sometimes, but of course not always, due to changes in the pre-natal environment. In both cases we talk of "varying penetrance". The grounds for this theory is obviously that the characteristic should be sensitive to very small changes. We talk about "all or nothing reaction". It is evident that in such cases the inner environment because of the random variation may have different effects in different parts of the embryo. In such cases we get facultatively asymmetrical characteristics. We can draw from this the important conclusion that small, purely accidental variations in the environment of the egg and in the embryo can have a decisive effect. The characteristics of a fully grown individual can be said to depend not only on inheritance and environment, but also on pure chance. We will later discuss this question more fully in connection with the problem of the differences between twins. Before we deal with this, however, we will discuss more closely asymmetrical characteristics, i. e. characteristics involving differences between the right and left side. These can arise in different ways.

Asymmetrical Characteristics.

If a gene is on the verge of asserting itself, it may happen that the random variations in the constitution of the cell substance, mentioned before, may result in the characteristic appearing asymmetrally. It also may be caused by the pre-natal environment varying over the limit necessary for this manifestation on one side of the embryo but not on the other. We might expect that such things would happen especially to characteristics which have a low penetrance.

It may be mentioned as an example that if you cross fowls with four toes with fowls with five, the heterozygote will sometimes show four toes on one side and five on the other, sometimes four toes on both sides etc. A single gene for five toes seems to have such little ability to assert itself alone that accidental variations are the decisive factor in determining the characteristic. As to the spots on certain species of animals these are the result of a special factor which restrains the appearance of colour. This factor may be said to reduce the penetrance of the genes so that they only assert themselves in certain places. Generally the colour does not appear on the ventral side but always on the dorsal. The limit of the appearance of the colour is not regular. This may be due to accidental factors in the cell

substance of the embryo but it seems to be more accurate to put the stress on the gene. The gene can sometimes manifest itself symmetrically and sometimes asymmetrically. Thus this is one type of genotypical asymmetry. Such asymmetries are, like other characteristics, due to environment as well as inheritance. As however, the variability of the pre-natal environment responsible for the asymmetrical appearance of a characteristic is always present, there is reason to lay the stress on the characteristic and speak of *Facultatively Genotypical Asymmetries*.

The other type is that represented by right and left handedness, situs inversus etc. in man. The genotypical asymmetry of this kind which has been most thoroughly investigated, is left and right coiling in snail shells (cf. fig. 1). The gene which causes the left

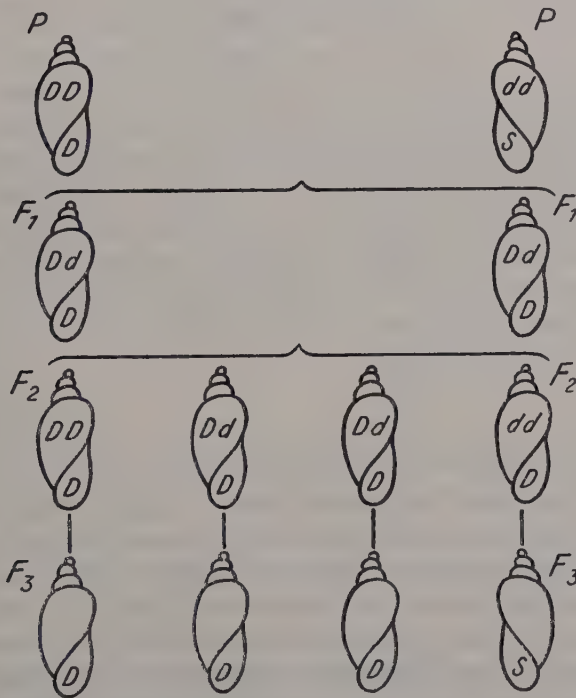


Fig. 1. Diagram showing inheritance of right- and left-coiled snail shells (*Limnaea peregra*). It should be observed that the individual furthest to the right in the F₂-generation is right coiled, although with regard to its genes it should be left coiled.

coiling is recessive. A homozygote of left coiling which comes from a heterozygote of right coiling becomes right coiled. The genes of the mother cause all her cells to become right coiled including the egg cells. The left coiled homozygote of this gene will be right coiled. The left coiling does not appear until the next generation. It has been possible to lead the coiling back to the position of the nuclear-pole in the first cell division. Consequently the fertilised egg is already differentiated into a caudal and cefal part and a dorsal and ventral part. After that the genes cause orientation to the left or right so that the nuclear pole is placed obliquely and the opposite side will be smaller in the subsequent cell divisions. There must exist a chemical difference between the different parts of the egg due to the genes. These genes seem to cause the asymmetrical organisation of every cell including those of the germ track which is, incidentally, so powerful that it is effective also in the new eggs which have genes of the opposite character.

It is possible that something similar happens with right and left handedness in man. I have previously put forward a theory about how such an asymmetry arises but I then assumed that the asymmetry in the egg is followed by a difference in the structure of the secondary cells. This is probably caused by some form of asymmetry in the primary organiser caused by some gene. Anyhow, it should arise in the same way as the asymmetry of the normal body. It is important from a practical point of view that genotypical asymmetries can appear on the right or left side or symmetrically or alternatively not appear at all in the next generation. They can in other words be latent.

Identical and Fraternal Twins from the Point of View of Heredity.

The genotypical asymmetries have a special importance with regard to twin investigations. Genotypical asymmetries can result in a characteristic appearing in only one of the twins and therefore cause differences between identical twins due not to environment or heredity but to some accidental factor or in certain cases to asymmetrical genes. For this reason investigations of identical twins must be used with greater caution than hitherto has been the case. The explanation is not always so simple as has before appeared. An example of a genuine genotypical asymmetry is right and left handedness. If lefthandedness is inherited as a recessive charac-

teristic, parents who are both lefthanded ought to have only left-handed children. However it often happens in such marriages one child or other is righthanded. This can hardly be explained by the father not being the husband. It points rather to a shifting mechanism of the kind mentioned in some of my cartier papers.

It is generally agreed that right and lefthandedness are entirely or partly inherited, but it has not been possible to find out in which way the mechanism works, perhaps because it may be question of a genotypical asymmetry which in a certain percentage presents shifting. With regard to the occurrence of lefthandedness in twins a survey of the results of different authors is given in Table 1.

Table 1.

Left and right handedness in twins.

Of the total number of identical twins, 1710 individuals, 14.33 ± 0.85 %, are lefthanded. Of the total number of fraternal twins, 1850 individuals, 10.60 ± 0.70 %, are lefthanded. The difference is 4.17 ± 1.10 %.

| Author | Identical twins, number of pairs | | | | Fraternal twins, number of pairs | | | |
|--|---|------------------|-------------------|----------------------------|----------------------------------|------------------|-------------------|----------------------------|
| | Number of pairs | Both left handed | Both right handed | One left, one right handed | Number of pairs | Both left handed | Both right handed | One left, one right handed |
| <i>Verschuer</i> (1932) | 244 | 11 | 156 | 77 | 178 | 8 | 136 | 34 |
| <i>Dahlberg</i> (1926) | 69 | 4 | 53 | 12 | 128 | 1 | 111 | 16 |
| <i>Siemens</i> (1924) | 37 | 1 | 26 | 10 | 31 | 2 | 16 | 13 |
| <i>Weitz</i> (1924) | 18 | 1 | 10 | 7 | — | — | — | — |
| <i>Norinder</i> (1946) | 144 | — | 130 | 14 | 269 | — | 250 | 19 |
| <i>Rife</i> (1940) (=total of <i>Newman, Wilson & Jones and Rife</i>) | 343 | 10 | 262 | 71 | 319 | 5 | 240 | 74 |
| Total | 855 | 27 | 637 | 191 | 925 | 16 | 753 | 156 |
| % of total number of pairs | — 3.16 ± 0.60 74.50 ± 1.49 22.34 ± 1.42 — 1.73 ± 0.43 81.41 ± 1.28 16.86 ± 1.23 | | | | | | | |
| Expected % | 2.05 73.39 24.55 — 1.03 80.71 18.26 | | | | | | | |

The frequency of lefthanded individuals varies according to different authors but for the total material it is higher in identical than in fraternal twins. The difference, 4.17 ± 1.10 %, is significant. If lefthandedness were inherited in the usual manner we should not find any identical twin pairs where one was lefthanded and the

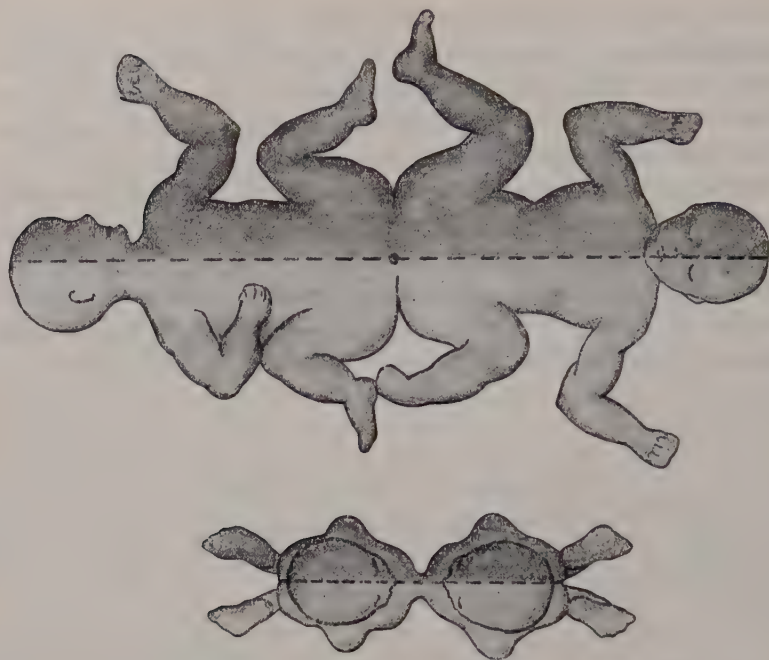


Fig. 2. Diagram showing how right- and lefthandedness may arise in identical twins. The dark halves of the figures indicate righthandedness.

other righthanded. Even if the percentage of lefthanded individuals may be uncertain because of the figures being more or less reliable, everybody seems to be agreed that there are many such pairs. Of the total material in Table 1 they make up 22.3 ± 1.4 %. This may be due to a certain action of intrauterine environmental factors, as Rife¹⁾ asserts. However it is possible that the mechanism is the one that I have suggested, i. e. it is question of a genotypical asymmetry which presents shifting.

The mechanism may be that shown in fig. 2. If one side of one of the twins is functionally better and the same side becomes func-

¹⁾ On the basis of his own and *Wilson* and *Jones*' material but without considering other earlier authors *Rife* asserts that left handedness is especially frequent among identical as well as among fraternal twins. This opinion however is dubious, to say the least of it. That no difference between identical and fraternal twins has shown up in the abovementioned material may be due partly to chance, partly to differences in the methods employed to decide if a person is left handed or not.

tionally better in the other twin than because of their position in relation to each other one becomes righthanded and the other left. If the mechanism were invariably like this one of each pair of identical twins should always be lefthanded and the other right. However this is not the case. The shift only seems to occur in a certain percentage and this may depend on the stage at which the double tendency first expresses itself.

An example of facultatively genotypical asymmetry is the appearance of cancer. It is well known that this can be caused by environmental factors as well as genetical ones. Lately it has been shown that certain virus are of great importance in determining this (cf. *Bittner* in 1944). It has long been obvious that chronic irritation especially the substances known as carcinogenical can have a strong effect. However their effect is dependent on the character of the genes, for the degree of facility of producing an effect varies between different strains of animals of the same species. A malignant tumour is due to a single cell or group of cells returning towards the embryo stage etc. If this is due to genetical factors, a very special mechanism must be at work. Genetical factors cannot carry with them a general tendency to become malignant. If they did, cancer would appear simultaneously at several points of a tissue or perhaps even in several different tissues. This is, as a rule, not the case, and it is just this that makes treatment by operation possible. If the primary tumour is successfully removed there is, usually, no risk of further tumours. As is well known, however, there are some exceptions to this rule.

Thus under these circumstances it is clear that the genes cannot produce a general tendency to cancer. The same applies to the external environment on the ground that if a cancer is caused by an irritation or something similar, one would expect the formation of tumours to be more widespread. It is difficult to imagine environmental factors only affecting certain points. There is however a third possibility. If we assume that heredity is responsible for a disposition to cancer, it implies that there is a tendency to miscarry in certain cells during cell division for example. Again, we can assume that the hereditary disposition to such a miscarriage is very small and that twins from a single egg, for example, have as a result a 1:30 chance per year of getting such a miscarriage as they grow older. The implication is that among the enormous sum total of cells and the great number of cell divisions that occur there is an infinitesimal

chance for each cell to become a cancer cell. If one reckons per individual instead of per cell the disposition becomes much greater. If it is 1 : 30 a year, it implies that one of a pair of identical twins might get cancer relatively early and the other 30–40 years later. With such pairs the later one ought to die of a disease other than cancer. The difference between the occurrence of cancer in single- and two-egged twins might therefore be very slight.

The situation might be illustrated by an analogy which, however, must not be carried too far. Let us assume that in two big towns the population has exactly the same genes and exactly the same environment. Let us then assume that this results in suicides being very rare so that the chances of it happening in a certain year is 1 : 30. If then, a suicide occurs in one of the towns in a certain year, then it may happen that it will be several years later that a suicide occurs in the other town although the genetical character and the environment are the same in the population of the two towns.

The Theory of Probability in Genetics.

When we make an estimate of the result of an unpredictable chain of causes e. g. the casting of a dice, we speak of probability. In these cases the probability is founded on incomplete evidence.

In modern atomic physics probability is used partly in another sense. The uncertainty which follows the movement of electrons is fundamental, in so far as that it cannot be decreased on further information below a certain limit, but where an electron moves depends on, what is for us, the unknown. This uncertainty is displayed in *Heisenberg's* uncertainty – relation which says that the uncertainty in the velocityimpulse multiplied by the uncertainty as to the electron's whereabouts is constant. In this case it can be called a question of primary probability because generally the probability is secondary to our incomplete information.

It seems as if our brain has only two fundamentals to work with, first, regularity, and second, probability. The first we have got, I think, from a feeling of necessity which is present when we make such statements as 2 and 2 make 4. The fundamental of probability arises, in my opinion, from the feeling of vagueness which within certain bounds, often follows statements as to our intention to act in the future.

In any case, the conception of probability is used at several points in genetics, that is at the sorting out of the genes in the sexual cells and at their combination with one another. I consider it might also be used with regard to the inner environment and facultatively genotypical asymmetries and that one ought to distinguish between not only heredity and environment but also those characteristics which appear by random variation. In researches into twins one generally seeks to divide the appearance of the characteristics into those dependent on heredity and environment and those dependent only on environmental factors. The accidental variations enter into the environment group if one uses the method I have given for dividing up the variability (*Dahlberg* 1926). Because of that, it would be better to speak about genetical factors and non-genetical factors. The probability of being able to separate by twin researches the factors depending on environment and those depending on random variation, is not very great at present.

With the help of bilateral characteristics, however, it may be possible to get some conception of the random variation due to differences inside the embryo by measuring the differences between right and left side. As a consequence, in twin research we have to distinguish between three kinds of variation:

1. Differences between right and left side which should mainly be due to random variation inside the embryo and should be a measure of the penetrance. However, genotypical asymmetries may also play some part (errors of measurement not included).

2. Differences between identical twins. These should be greater than the aforementioned differences because of the added affect of environment. If it is not possible to subtract the effect of random variation this variation should be called non-genetical variation.

3. Differences between fraternal twins. These should be greater than those between identical twins because of the added effect of gene differences. By subtracting the variation of identical twins, using appropriate formulae, we get the variation due to heredity.

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